Incorporations

Edited by Jonathan Crary and Sanford Kwinter

zone

ZONE Editors: Jonathan Crary, Michel Feher, Sanford Kwinter, Ramona Naddaff
Editors of this volume: Jonathan Crary and Sanford Kwinter
Managing Editor: Elizabeth Felicella
Design: Bruce Mau
Design Schema: Sanford Kwinter and Bruce Mau
Production: Ed Cleary, Alison Hahn, Vilip Mak, Kathleen Oginski, Nigel Smith, Gregory Van Alstyne.

Image Research Coordinator: Elizabeth Felicella with Naomi Jackson, Suzanne Jackson, Carole Naggar, Keith Seward, Steve Snyder, Kristen Vallow, Timothy Wright
Manuscript Editor: Ted Byfield
Editorial Coordinators: Rennie Childress and Meighan Gale with Suzanne Jackson, Linda Kelly, Rachel Robbins, Keith Seward, Kristen Vallow, Thad Ziolkowski.
Translations: Randall Cherry, Mark Cohen, Robert Hurley, Martin Joughin, Donald Leslie, Brian Massumi, Delphine Bechtel, Ted Byfield.
Fundraising and Advertising: Céline Cazals de Fabel
Initiating Projects Editor: Kerri Kwinter
Special Thanks: Brian Boigon, Lois Burke, Anne Dixon, Ed Epstein, Jason Greenberg, Virginia Heckert, Barbara Hoffman, Christian Hubert, Alex Kessler, Gus Kiley, Andy Levine, Kerry McCarthy at AP/World Wide, Melissa Mathis, Jeffrey Meikle, Erica Meinhardt, Anne Mensior of CLAM, Guillaume Paris, Gilles Peress, Guy Poulin, Jackie Raynal, Wendelin Scott, Carina Snyder, Susan Spiegel, Tim Sternberg, Aiyemobisi Williams, Thomas Jean Yee; Aperture Magazine, Avery Library, CRT Artificio, Museum of Modern Art Photography Department, Photofest, Telescope Magazine, University of California at Riverside Photography Museum.

We gratefully acknowledge the generous support of the National Endowment for the Arts, Tom Cugliani Gallery, Lorence Monk Gallery, Nahan Gallery, Marian Goodman Gallery, Vincent Wapler, John Weber Gallery, Salvatore Ala Gallery, Leo Castelli Gallery, Vrej Baghoomian, Sidney Janis.

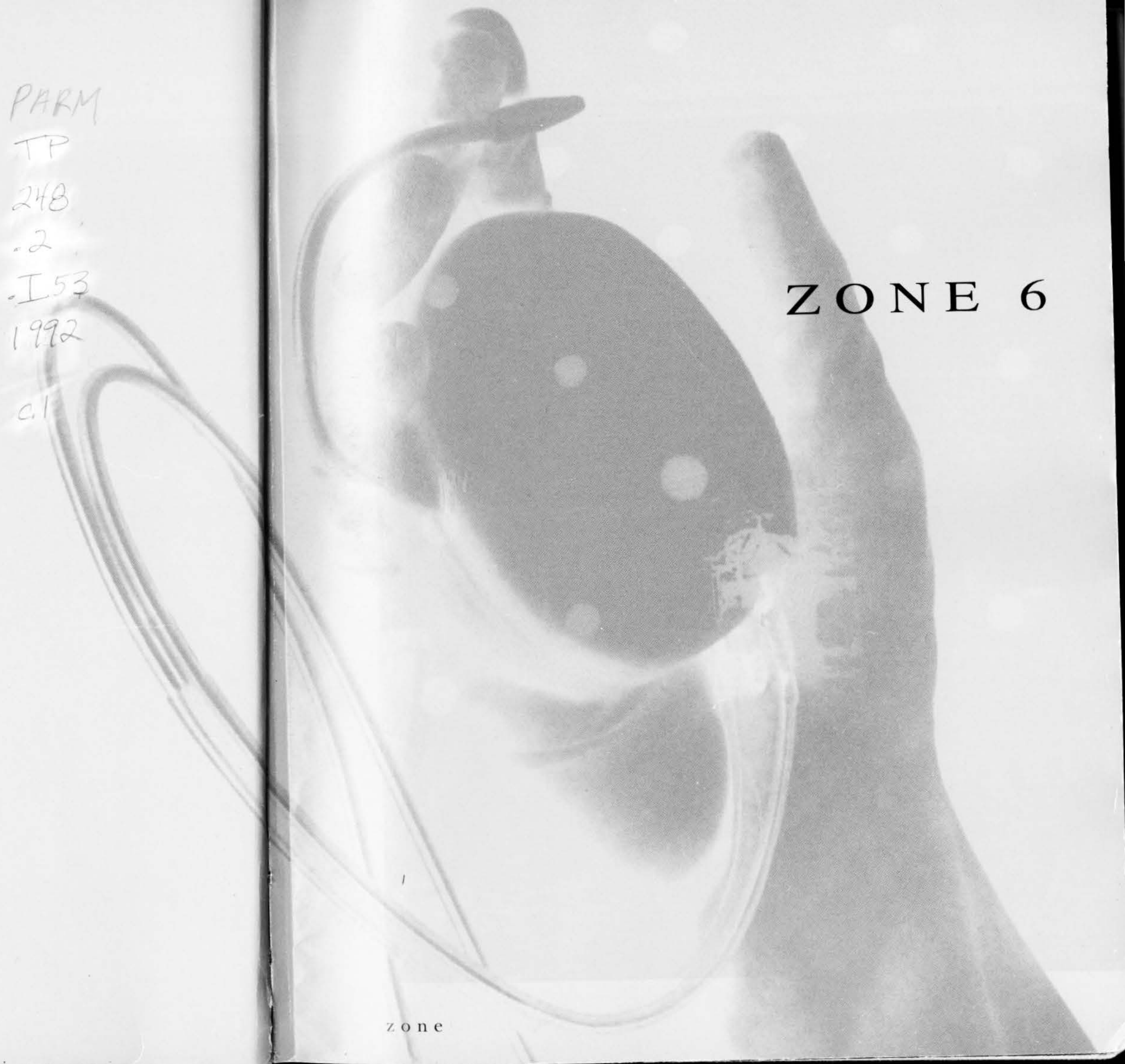
© 1992 Urzone, Inc.

ZONE 611 Broadway Suite 608
New York, NY 10012

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, including electronic, mechanical, photocopying of microfilming, recording, of otherwise (except that copying permitted by Sections 107 and 108 of the U.S. Copyright Law and except by reviewers for the public press) without written permission from the Publisher.

Printed in Canada by Bradbury Tamblyn & Boorne Ltd.
Distributed by The MIT Press.
ISBN: 0-942299-29-9 (paper) 0-942299-30-2 (cloth)
Library of Congress Catalog Card Number: 88-051439

PARM
TP
248
.2
.I53
1992
c.1



ZONE 6

zone

Jean Paul Sartre 386 Intentionality

Leif Finkel 392 The Construction of Perception

Frederick Turner 406 Biology and Beauty

Peter Eisenman 422 Unfolding Events

Bill Krohn 428 Full Metal Jacket

Mark Poster 436 Robocop

Nina Rosenblatt 441 Performance

Paul Virilio 446 Aliens

Jean-Pierre Gorin 450 My Crasy Life

Marcel Mauss 454 Techniques of the Body

Peter Fend 478 Spine, City, Form

Susan Foster 480 Dancing Bodies

Ellen Lupton/J. A. Miller 496 Hygiene, Cuisine and the Product World

François Dagognet 516 Toward a Biopsychiatry.

Victor Tausk 542 The Influencing Machine

Judith Barry 570 Mappings: A Chronology of Remote Sensing

Ronald Jones 572 Biological Ramparts

Eve Kosofsky Sedgwick 582 Epidemics of the Will

Leone & Macdonald 596 Passio Perpetuae

Allucquère Roseanne Stone 608 Virtual Systems

Paul Rogers 626 The Myth of the Clean War

Gilles Deleuze 628 Ethology: Spinoza and Us

zone

Jonathan Crary/Sanford Kwinter 12 Foreword

Félix Guattari 16 Regimes, Pathways, Subjects

Donna Haraway 36 When Man™ is On the Menu

Georges Canguilhem 44 Machine and Organism

Hillel Schwartz 70 Torque: The New Kinaesthetic of the Twentieth Century

Manuel DeLanda 128 Nonorganic Life

Ana Barrado 168 Angular Momentum

Anson Rabinbach 178 Neurasthenia and Modernity

Lisa Cartwright/Brian Goldfarb 190 Radiography, Cinematography and the Decline of the Lens

Didier Deleule 202 The Living Machine: Psychology as Organology

Paul Rabinow 234 Artificiality and Enlightenment: From Sociobiology to Biosociality

Victor Bouillion 253 War and Medicinema

Heidi Gilpin 254 Tadeusz Kantor

Klaus Theweleit 256 Circles, Lines and Bits

John O'Neill 264 Horror Autotoxicus

J. G. Ballard 268 Project for a Glossary of the 20th Century

Gilles Deleuze 280 Mediators

Gilbert Simondon 296 The Genesis of the Individual

Francisco Varela 320 The Reenchantment of the Concrete

Elaine Scarry 340 Arbeit Medallion

Diller and Scofidio 344 Case No. 00-17163

Dorion Sagan 362 Metametazoa: Biology and Multiplicity

Foreword

Incorporations outlines a complex motif central to the understanding of our contemporary world, one inseparable from the myriad forces through which humans have continually sought to make and remake themselves modern. This title encompasses at once themes of integration — the integration of human life forces into the larger-than-human systems of social and technical organization; as well as the finer-grained processes of embodiment — those strategies through which human life combines with, and assimilates, the minute, shifting, often invisible patterns and rhythms of the concrete historical milieus within which it unfolds.

In the first category may be included all those processes — economic, ergonomic, scientific and social — that evolved from the new managerial and disciplinary techniques introduced within the great state bureaucracies and industrial assemblages of the later nineteenth century. This turning point was marked by the first systematic transfer of the human will to mastery away from the non-human world of nature to the knowledge, management and control of a human nature as well. The flux and energy of human life became increasingly reduced to finite quantities of force and sensation, allowing it to be evermore efficiently subsumed and deployed in schools, factories, hospitals and households by the productivist and rationalizing imperatives of a capitalist megamachine.

With the second category we mean to conceive of the individual's practical relation to its milieu as a dynamic system of local, interdependent, self-updating movements, perceptions and gestures. Such a system would proceed through the capture of, and adaptation to, specific socially and technically generated patterns and effects, for example, the way new industrial speeds and rhythms were adopted at the turn of the century alongside new fluid models of human movement, kinaesthetics and energy.

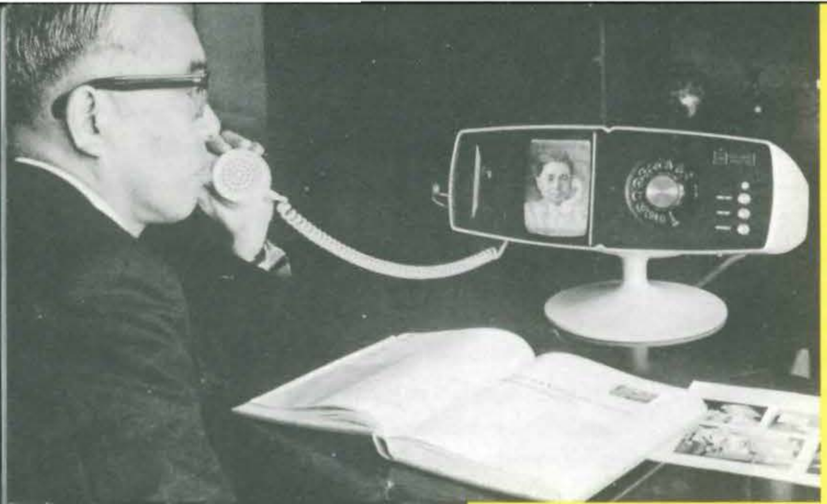
Our book then, is a dynamical map of the pathways, accidents and strategic evolutions out of which the very problem of "life" itself first arose as a specific and autonomous concept, and how life, in its simultaneously quotidian, menacing and delirious concreteness, became what it is within twentieth-century modernity. Our topic is the problem of life itself, understood as a complex, labile, overtone structure, neither dependent upon, nor reducible to, an organic substrate or historical object — in short, to what contemporary habit too knowingly calls "the body." Rather, this volume addresses the forces — aesthetic, technical, political, sexual — with which things combine in order to form novel aggregates of pattern and behavior. In still other ways, moreover, it is about these processes of formation themselves, understood as a larger fundamental evolutionary process to which we humans belong as a central though otherwise unprivileged part. For this reason it is no coincidence that a number of essays in this volume contain the prefix bio- in their titles, indeed many others could have. But if a specifically biological modality has become operative here, it is an indication of the vast transformations in techniques of knowledge that continue to occur since the demise of the mechanical model of explanation in the nineteenth century.

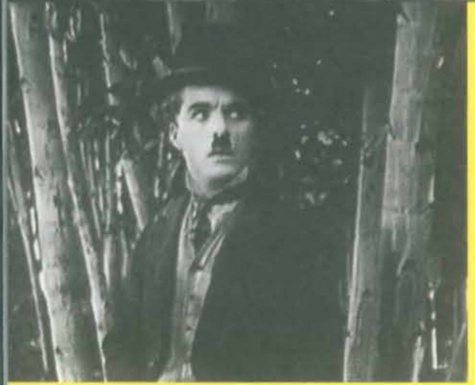
The modern problem of life then, is unthinkable apart from another set of figures, that of the organism and the machine. Although profound and nearly invisible processes of economic subsumption have never ceased effecting the convergence of the biological and mechanical spheres of existence, what is changing today, and what our book in a partial way attempts to chart, is how the classical processes of the mechanization of life are giving way to a new and unprecedented vitalization of the machine. This development in no way signals a monolithic historical shift but rather a proliferation at a variety of levels of new virtual pathways and historical countermovements which have the potential to be used or activated in diverse and opposing ways. Though many of these tendencies are either already stabilized in familiar social arrangements or deeply embedded in the inexorable movements of contemporary regimes of power and production, there are others that remain volatile, paradigm-resisting forces, full of unknown and unforeseeable capacities for cognitive and cultural transformation.

The book develops along two axes: one traverses certain features of our own contemporaneity, here represented by works of philosophers, neuroscientists, architects, filmmakers, artists and others; the other axis is historical, tracing lines of development from the late nineteenth century to the present. The choice to elaborate these two axes simultaneously underscores how current transformations of biological and technological arrangements are neither the result nor the sign of some recent shift in cultural paradigms, but instead are part of ongoing processes of modernization traceable to the second half of the nineteenth century at least.

One of the aims of this book, then, is to outline the ways in which overlapping "biotechnic" arrangements have throughout the twentieth century brought about continuous transformations of a "lifeworld." Though the same relentless processes of modernization and rationalization continue today unabated, they have become increasingly and inseparably linked to the positive production of such generalized lifeworlds or ambient milieus as sites of invention and transformation. Neither human subjects nor the conceptual or material objects among which they live are any longer thinkable in their distinctness or separation from the dynamic, correlated, multipart systems within which they arise. Every thing, and every individual emerges, evolves and passes away by incorporating and being incorporated into, other emerging, evolving or disintegrating structures that surround and suffuse it. Indeed, incorporation may well be the name of the new primary logic of creation and innovation in our late modern world.

— Jonathan Crary and Sanford Kwinter





Project for a Glossary of the Twentieth Century

J. G. Ballard

X-ray Does the body still exist at all, in any but the most mundane sense? Its role has been steadily diminished, so that it seems little more than a ghostly shadow seen on the X-ray plate of our moral disapproval. We are now entering a colonialist phase in our attitudes to the body, full of paternalistic notions that conceal a ruthless exploitation carried out for its own good. This brutish creature must be housed, sparingly nourished, restricted to the minimum of sexual activity needed to reproduce itself and submitted to every manner of enlightened and improving patronage. Will the body at last rebel, tip all those vitamins, douches and aerobic schedules into Boston harbor and throw off the colonialist oppressor?

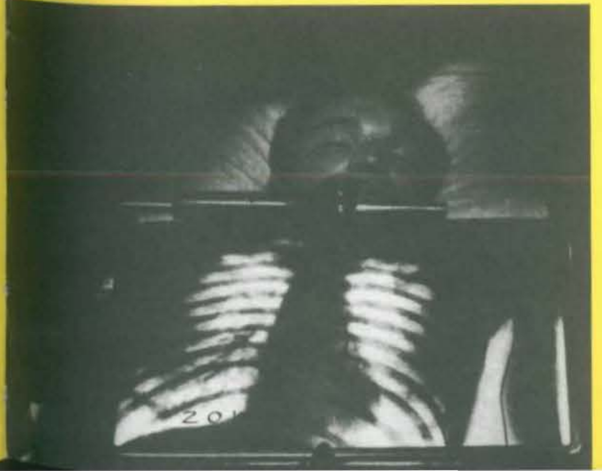
Typewriter It types *us*, encoding its own linear bias across the free space of the imagination.

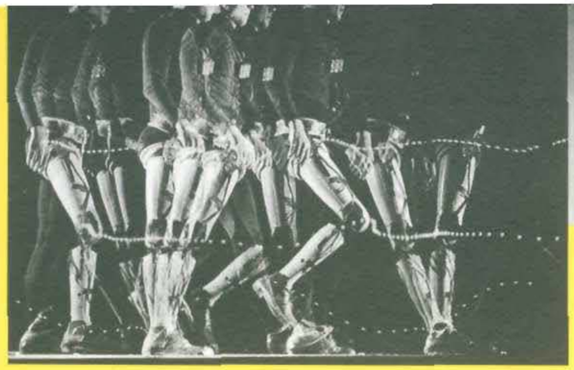
Zipper This small but astute machine has found an elegant way of restraining and rediscovering all the lost enchantments of the flesh.

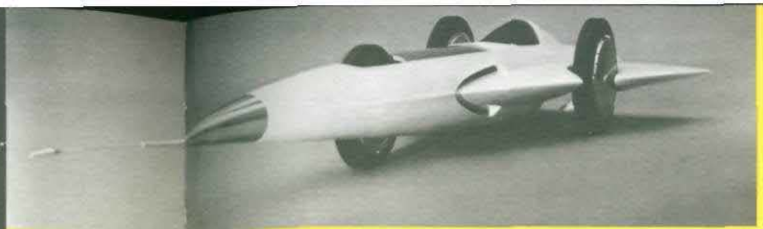
Jazz Music's jettisoned short-term memory, and no less poignant for that.

Telephone A shrine to the desperate hope that one day the world will listen to us.

Chaplin Chaplin's great achievement was to discredit totally the body, and to ridicule every notion of the dignity of gesture. Ponderous men move around him







like lead-booted divers trying to anchor the central nervous system to the seabed of time and space.

Trench warfare The body as sewer, the gutter of its own abattoir, flushing away its fears and aggressions.

The pill Nature's one step back in order to take two steps forward, presumably into the more potent evolutionary possibilities of wholly conceptualized sex.

Aerodynamism Streamlining satisfies the dream of flight without the effort of growing wings. Aerodynamics is the motion sculpture of non-Euclidean space-time.

Pornography The body's chaste and unerotic dream of itself.

Time and motion studies I am both myself and the shape that the universe makes around me. Time and motion studies represent our attempt to occupy the smallest, most modest niche in the surrounding universe.

Prosthetics The castration complex raised to the level of an art form.

Biochemical warfare Nerve gases — the patient and long-awaited revenge of the inorganic world against the organic.

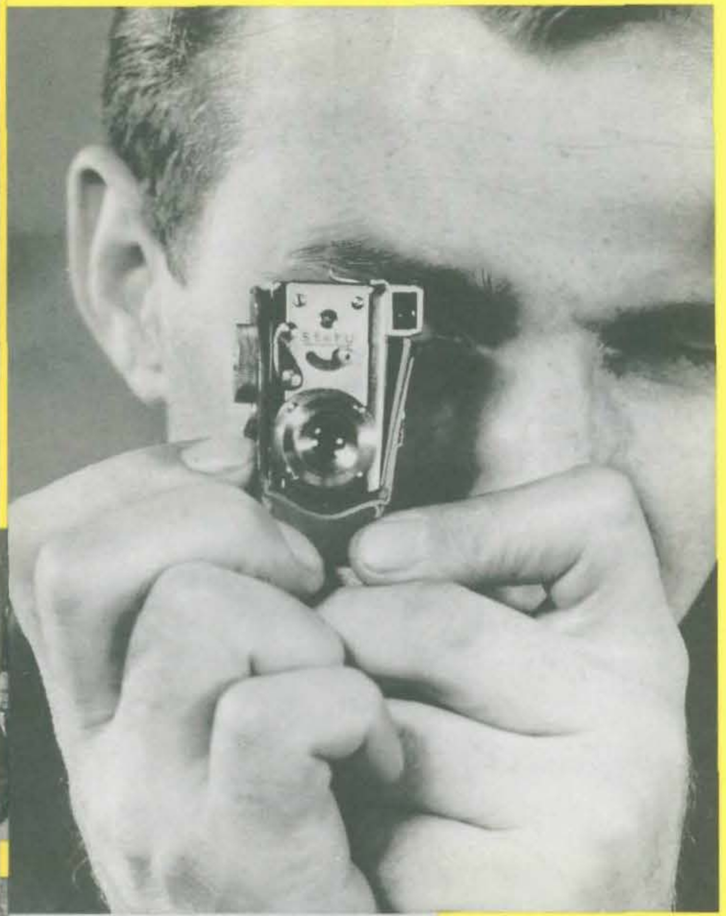
Hallucinogenic drugs The kaleidoscope's view of the eye.

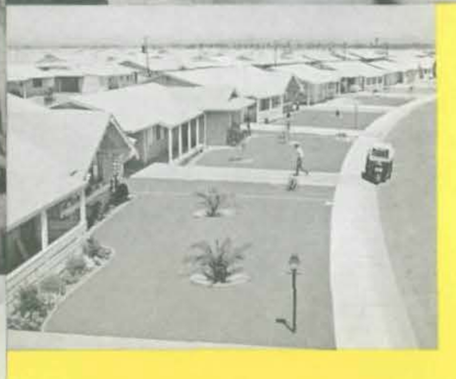
The Warren Commission Report The novelization of the Zapruder film.

Genocide The economies of mass production applied to self-disgust.

Phenomenology The central nervous system's brave gamble that it exists.

Crowd theory Claustrophobia masquerading as agoraphobia or even, conceivably, Malthusianism.





Lysenkoism A forlorn attempt not merely to colonize the botanical kingdom, but to instill a proper sense of the puritan work ethic and the merits of self-improvement.

Robotics The moral degradation of the machine.

Suburbs Do suburbs represent the city's convalescent zone or a genuine step forward into a new psychological realm, at once more passive but of far greater imaginative potential, like that of a sleeper before the onset of REM sleep? Unlike its unruly city counterpart, the suburban body has been wholly domesticated, and one can say that the suburbs constitute a huge petting zoo, with the residents' bodies providing the stock of furry mammals.

Forensics On the autopsy table science and pornography meet and fuse.

Miniaturization Dreams of becoming very small predate Alice, but now the probability grows that all the machines in the world, like the gold in Fort Knox, might be held in one heavily guarded location, protected as much from themselves as from the rest of us. Computers will continue to miniaturize themselves, though, eventually disappearing into a microverse where their ever-vaster calculations and mathematical models will become one with the quarks and the charms.

The Vietnam War Two wholly incompatible martial systems collided, with desperate result. Could the Vietcong, given a little more TV savvy, have triumphed sooner by launching an all-women guerrilla army against the *Playboy*-reading GIs? "First Air Cavalry ground elements in Operation Pegasus killed 350 enemy women in scattered contacts yesterday, while Second Division Marines killed 124 women communists…"

Isadora Duncan The machine had its own fling with her overdisciplined body, the rear wheel of her car dancing its lethal little jig around the end of her scarf.

Furniture and industrial design Our furniture constitutes an external constellation of our skin areas and body postures. It's curious that the least imaginative of all forms of furniture has been the bed.

Schizophrenia To the sane, always the most glamorous of mental diseases, since it seems to represent the insane's idea of the normal. Just as the agnostic world keeps alive its religious festivals in order to satisfy the vacation needs of its workforce, so when medical science has conquered all disease certain mental afflictions, schizophrenia chief among them, will be mimicked for social reasons. By the same token, the great appeal of alcoholism, and the reason why it will never be eliminated, is that it provides an opportunity for honorable and even heroic failure.

Body-building Asexual masturbation, in which the entire musculature simulates a piece of erectile tissue. But orgasm seems indefinitely delayed.

Epidemiology Catastrophe theory in slow motion.

Fashion A recognition that nature has endowed us with one skin too few, and that a fully sentient being should wear its nervous system externally.

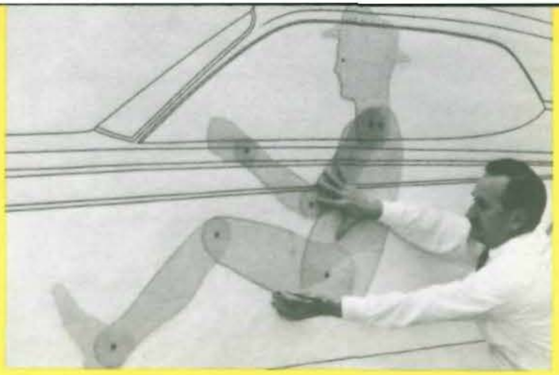
Automobile All the millions of cars on this planet are stationary, and their apparent motion constitutes mankind's greatest collective dream.

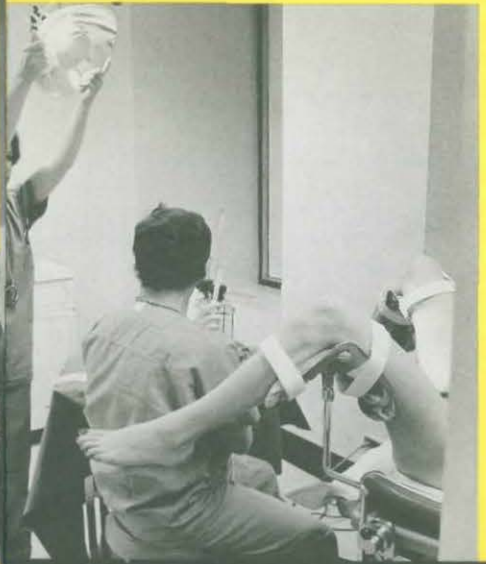
Skyscraper The eight-hour city, with a tidal population clinging to the foreshore between Earth and the yet to be navigated oceans of space.

Pasolini Sociopath as saint.

Transistor If the wheel is 1 on the binary scale, the transistor is 0 — but what will be 1000001?

Retroviruses Pathogens that might have been invented by science fiction. The greater the advances of modern medicine, the more urgent our need for diseases we cannot understand.





Money The original digital clock.

Abortion Do-it-yourself genocide.

Science fiction The body's dream of becoming a machine.

Answering machines They are patiently training us to think in a language they have yet to invent.

Genetics Nature's linguistic system.

Food Our delight in food is rooted in our immense relish at the thought that, prospectively, we are eating ourselves.

Neurobiology Science's Sistine Chapel.

Criminal science The anatomizing of illicit desire, more exciting than desire itself.

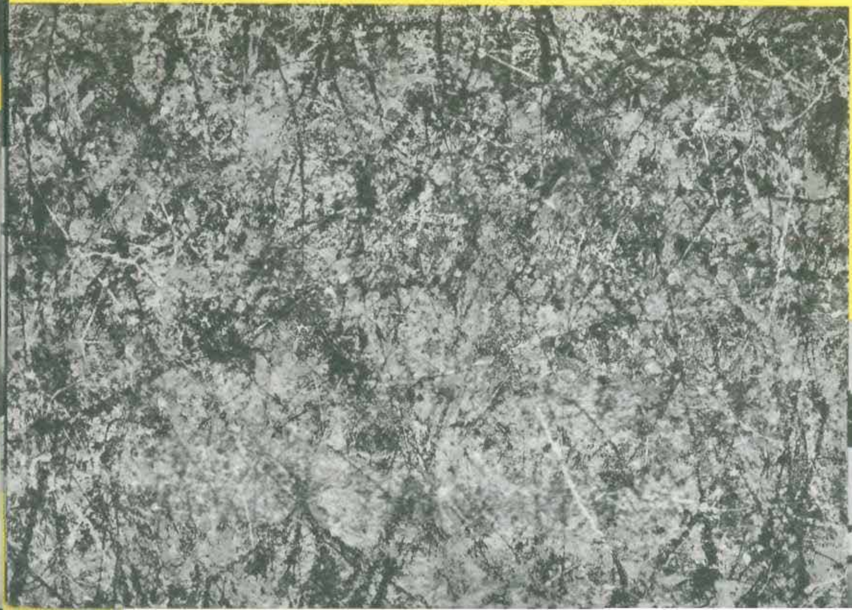
Camouflage The camouflaged battleship or bunker must never efface itself completely, but confuse our recognition systems by one moment being itself, and the next not itself. Many impersonators and politicians exploit the same principle.

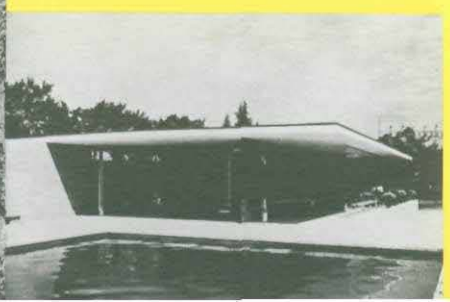
Cybernetics The totalitarian systems of the future will be docile and subservient, like super-efficient servants, and all the more threatening for that.

Disease control A proliferation of imaginary diseases may soon be expected, satisfying our need for a corrupt version of ourselves.

Ergonomics The Protestant work ethic disguised as a kinaesthetic language.

Personal computers Perhaps unwisely, the brain is subcontracting many of its core functions, creating a series of branch economies that may one day amalgamate and mount a management buy-out.





War The possibility at last exists that war may be defeated on the linguistic plane. If war is an extreme metaphor, we may defeat it by devising metaphors that are even more extreme.

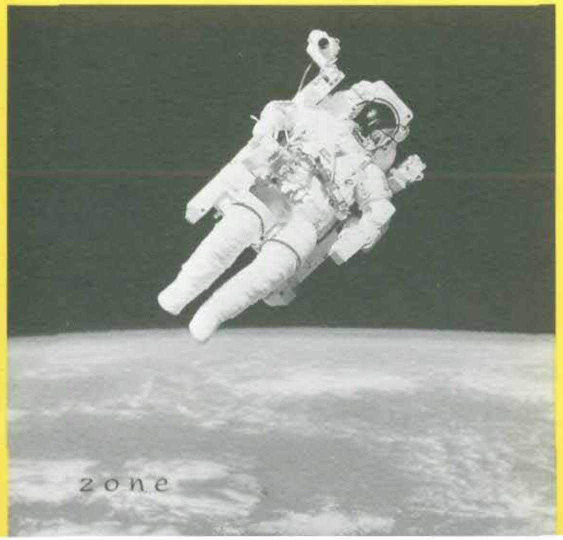
International Standard Time Is time an obsolete mental structure we have inherited from our distant forebears, who invented serial time as a means of dismantling a simultaneity they were unable to grasp as a single whole? Time should be decartelized, and everyone should set his or her own.

Satellites Ganglions in search of an interplanetary brain.

Modernism The Gothic of the information age.

Apollo mission The first demonstration, arranged for our benefit by the machine, of the dispensability of man.

Note: The glossary headings were among a list supplied by the editors to Mr. Ballard, who provided their substance.



Radio Listener, c. 1929.
Alexander Rodchenko

Near the close of the mechanical age, the evolution of the space and character of human social interaction has thrice been radically altered. This transformation was produced by a succession of prosthetics: the development of prosthetic speech in the form of disembodied voices heard through acoustic transducers; by prosthetic writing as text on monitor screens; and by prosthetic proxemics in the form of interactive video. As a result, but in quite different ways for each, the locus and character of the social arenas of Western industrialized societies shifted. Overall, in character this has meant a change from individual or group interaction, which implied physical presence, to decentered and fragmented communication whose nature and quality took on rapidly shifting and fundamentally novel forms. In locus, it meant a shift from a physical space whose geographical coordinates resist traditional modes of representation.

The kind and quality of human interactions created by these shifts — interactions of a character quite unrecognizable from the standpoint of geographically located agoras — have been described in many different ways. Usually they are referred to as networks, whether local or globally distributed. Science fiction writers have for some time been interested in such spaces and their potential for redefining social interaction. In the science fiction world they have still more names — mirror worlds, the net, consensual loci, the matrix, cyberspace. In fictional form they have served as rallying points and working metaphors for widely various organizations, theoreticians and experimenters. In "real" form, as interactive computer systems and the possibilities that such systems imply for novel sociality, they have acted as powerful attractors for a broad spectrum of interests that includes the military, big (and small) business, psychology and education, as well as computer, social and cognitive science.

Perhaps the best-described of these worlds of phantasmic social interaction is cyberspace, a term that has quickly passed from provocative literary fantasy to a hotly contested financial, cultural and ethical frontier. I find the vast amounts of energy (and hard cash) expended on computer systems designed around the metaphor of cyberspace to be particularly intriguing — because cyberspace itself does not yet even exist.

Cyberspace is a physically inhabitable, electronically generated alternate reality, entered by means of direct links to the brain — that is, it is inhabited by refigured human "persons" separated from their physical bodies, which are parked in "normal" space. The physical laws of "normal" space need not apply in cyberspace, although some experiential rules carry over from normal space — for example, the geometry of cyberspace is, in most depictions, Cartesian. The "original" body is the authenticating source for the refigured person in cyberspace: no "persons" exist whose presence is not warranted by a physical body back in "normal" space. But death in either normal space or cyberspace is real, in the sense that if the "person" in cyberspace dies, the body in normal space dies, and vice versa.

To some extent, though, cyberspace already exists as a metaphor for late twentieth-century communications technologies (databanks, financial systems, ATMs). Many of us already live at least part-time in cyberspace, but call it "computer conferencing," "phone sex," banking, or "virtual" this or that. Insofar as these activities involve communicating with other people through narrow-bandwidth media, though, it may be understood in terms of negotiating the tensions between individual subjects, virtual collectivities and the physical bodies in which they may or may not be grounded. Proto-cyberspace has been around for many years in various forms — visually as *dioramas* and *botanical gardens*, aurally as radio dramas, kinesthetically as carnival rides and textually, perhaps, as novels.

Cyberspace has achieved visibility in the context of late capitalism, in the historic moment of "biosociality" — Paul Rabinow's term for the collapse of the distinctions between biological observation, construction and control (as in the Human Genome Project) — or "technosociality," the state in which technology and nature are the same thing, as when one inhabits a network as a social environment. Cyberspace is a social environment: the networks are elsewheres where we can observe new collective structures risking themselves in novel conditions. These structures take the form of organized and moderated conferences, multiuser groups, anarchic chats, clandestine assignations. Some are trivial, but some are definitely not trivial and have real effects outside the nets. Some of the interactions are gendered, stereotypical, Cartesian, reifying old power differentials whose workings are familiar and whose effects are well understood; but some of the interactions are novel, strange, perhaps transformative.

This essay is about science fiction, in the sense of emerging technologies, shifting boundaries between the living and the nonliving, optional embodiment — in other words, the everyday world as cyborg habitat. It is not about cyberspace, but rather social systems arising in phantasmic spaces enabled by, and constituted through, communication technologies. To some extent, they exist in the cultural milieu suggested by recent cyberspace metaphors; but they also considerably predate the last decade.

I am not a neutral observer — I am interested in the nets for what they make visible about the "real" world, things that might otherwise go unnoticed. I am interested because of their potential for emergent behavior, for new social forms that arise in a circumstance in which "body," "meeting," "place" and even "space" mean things quite different from our accustomed understanding. How tenacious are these new social forms in the face of adversity, and what can be learned from them about social problems outside the worlds of the nets? How do groups of friends evolve when their meeting room exists in a purely symbolic space? How does narrowing the bandwidth — that is, doing without customary modes of symbolic exchange such as gesture and tone of voice — affect sharing and trust, and how do inhabitants of virtual systems construct and maintain categories such as gender and race? How do people without bodies make love?

This trek into the mysterious depths of technology — which in the case of computer technology is ultimately the binary — in search of the natural is a familiar classical trope. Of course there is an ironic twist to this Conradian search: I am suggesting a venture not into the heart of "nature" in search of redemption, but rather into the heart of "technology" in search of nature — and not nature as object, place or originary situation, but in Donna Haraway's sense nature as Coyote, the Native American trickster — diversity, flexibility, irruption, danger, playfulness — put briefly, nature as actant, as process, a continual reinvention and encounter actively resisting representation.

By entering into technology we tacitly agree to view certain imaginary movements as literal. This action activates the extreme permeability of boundaries between a politically authorized social entity and a technical prosthetics that characterizes the technosocial. In the space we find there, at once technological and social, we become aware of new kinds of beings who inhabit the phantasmic spaces of technology. They are at home in an environment whose existence has not even been recognized by those not deeply immersed in an age of instantaneous communication — they are beings for whom technology is nature, for whom elsewhere is geography, for whom the problematic tie between unitary awareness and unitary physical body has political consequences. Frequently, we see them juxtaposed with more familiar social beings, and the contrast is jarring. We are used to encountering legally and epistemologically validated social units that are fixed in place by a dense network of location technologies. Interpreting them as such is by now a reflex, from "true names" (a persistent obsession of governments) to "legal addresses." In these efforts to fix the location of the political subject, other problematic couplings, such as the tie between body and the located self, pass almost unnoticed. I have proposed the idea of fiduciary subject as a useful way of articulating the (always political) tie between what our society defines as a single physical body and a single awareness of self.

In contrast, I have juxtaposed the mode of the technological, which is in many of its aspects the mode of the computer nets — which, in turn, evoke fragmentation and multiplicity as an integral part of social identity. The multiple personality is a preexisting example of such a social mode. In the language of the computer programmers who inhabit the frontiers of the technosocial, multiple personality is a mode that is already in place, fairly debugged in the current release; multiples exist around us, here and now — and regardless of the bad press accorded to Multiple Personality "Disorder," many remain invisible, living their lives quietly and gracefully. The multiple is the enantiomorph, the opposite of the socializer within the networks who exists in the mode of multiplicity outside a unitary physical body located at a terminal in another elsewhere.

The cyborg, the multiple personality, the cyberspace cowboy suggest radical rewritings in the technosocial space — in which everything is writing (computer code) — of the definition of body, the cultural meaning of bodies, and of the bounded individual as the standard social unit and validated social actant. As, for example, with the well-known multiple Truddi Chase, who consists of ninety-two supposed "functions," Thyrza Goodeve points out that

> Truddi's troops (who, for the most part, significantly, do not go by conventional "names," but by what we might call "functions" — The Interpreter, The Gate Keeper, The Buffer, The Recorder, for example) — explain their origin as "an intellectual reproduction system." The individual, imploding under the pressures of her material conditions, disappears, and the emergent construction, developing from the ashes of violence, seems something much closer to the population of a "small town," or an ever flickering series of switching television channels — but never that embattled Cartesian cogito so often presumed by the pronoun "I."

Such fractured identities call attention to alternatives, always multiple, always in tension. Just as changes in complex "real-world" political economies presage a radical simplification of biological diversity, the ramifications of complex social systems in the alter-space of communications technologies suggest a war between simplification and multiplicity... an explosion of actors and actants that includes the almost-living, the not-living and the never-living arising in the boundaries between technology, society and "nature," in the architectures of multiple embodiments and multiple selves. We already have a considerable industry built around these possibilities, although we never say so. There is, of course, nothing fortuitous about this. Never has so much money and attention been paid to a phenomenon that originated as science fiction no more than seven years ago. A look at the origins of virtual systems may suggest that the effort is driven by more than either defense needs or market forces can explain. We might begin not with the multiple subjectivities of the inhabitants of a computer network, but rather with an example of multiple personality from a recent newspaper article:

> On July 23, 1990, a 27-year-old woman filed a complaint in Oshkosh, Wisconsin, charging that Mark Peterson, an acquaintance, raped her in her car. The woman had been previously diagnosed as having Multiple Personality Disorder (MPD). She claimed that Peterson raped her after deliberately drawing out one of her personalities, a naive young woman who he thought would be willing to have sex with him.

Such a story is situated in a tangle of multiply nested assumptions. One thread of this tangle is that subjectivity is invariably constituted in relation to a physical substrate — that subjects must be associated with bodies. Another is that we know unproblematically what "body" is. We have been raised with the social imperative that there is one primary persona or "true identity" and that in the offline world — the "real world" — this persona is firmly attached to a single physical body by which our existence as a social being is authorized, and in which it is grounded.

There can be productive interventions into our cultural belief that the unmarked social unit, besides being white and male, is a single self in a single body. Multiple Personality "Disorder" (MPD) is one. MPD is generally considered to be pathological, the result of trauma. But we can look to the medicolegal construction and management of pathology for the circumstances that constitute and authorize the unmarked, in order to take the pathologization of MPD — and generally the management and control of any manifestations of body-self other than the one body-self norm — to be useful tools for taking apart discourses of the political subject. There are other interventions to be made, and I will interrogate the elsewhere of virtual space, that new phantasmic "structure" within which real social interactions take place.

* * *

Let me tell you a boundary story, a tale of the nets, as a means of anchoring one corner of the system of discourse within which this discussion operates. This story is about a totally disabled older woman who could still push the keys of a computer with her headstick. The personality she wore on the net was huge, though, and her disability was invisible and irrelevant. Her standard greeting was an expansive "HI!!!!!!" She was sympathetic and intelligent, and in the intimate electronic companionships that can develop during online conferencing between people who may never physically meet, her women friends shared their deepest troubles, and she offered them advice that helped make significant changes in their lives.

After several years, something happened that badly shook the conference's participants. We learned that she was only an online persona; that in her offline life she was a middle-aged male psychiatrist. How had this come about? Logging on to the conference for the first time, he had accidentally begun a discussion with a woman who mistook him for another woman. "I was stunned at the conversational mode," he said later. "I hadn't known that women talked among themselves that way. There was so much more vulnerability, so much more depth and complexity. Men's conversations on the nets were much more guarded and superficial, even among intimates. It was fascinating, and I wanted more."

He spent considerable time carefully choosing and then developing the right persona. A totally disabled, single older woman seemed perfect for his purpose: he assumed that she wouldn't be expected to have a social life offline. It worked for years, until one of her devoted admirers, bent on finally meeting her in person, tracked her down. The news of their meeting and the discovery of the woman's offline male persona traveled quickly through the conference. Reactions varied from humorous resignation to blind rage. Those most deeply affected were the women who had shared their innermost feelings with her. "I felt raped," one said. "I felt that my deepest secrets had been violated." Several went so far as to repudiate the gains they had made in their personal and emotional lives, which they felt to be predicated on deceit and trickery. But the computer engineers, the people who wrote the programs by means of which the nets exist, just smiled tiredly. They had understood from the beginning that the nets presaged radical changes in social conventions, some of which would go unnoticed until such an event brought them to the foreground. Some of these engineers, in fact, wrote software for the utopian possibilities it offered. Young enough to react and adjust quickly in the first days of the net, they had long ago taken for granted that many of the pre-net assumptions about the nature of identity had quietly vanished.

There is a subtext here, which relates to what I have been calling the online persona. Of course we all change personae all the time to suit the social occasion, although with online personae the act is more purposeful. The actively multiple, situational and fragmented character of the online persona calls into question commonsense notions of the relationships between communities and the individuals that constitute them. We take as starting points that communities are made up of aggregations of individual "selves," and that each "self" is equipped with a single physical body. I tell inquiring scholars that at the Group for Study of Virtual Systems we refer to this assumption as BUGS — a Body Unit Grounded in a Self. The notion of the self as we know it, called in various studies the "I" and in others the "subject", that tenacious just-so story that goes on to assure us that there exists an "I" for each body and that while there can be more than one "I" on tap there can only be one present at any time, seems a natural and inevitable part of life. It was just this kind of story that we told each other to hide the complexities of gender and of what we call "race," until theoreticians of gender and culture made the practices visible and showed how their invisibility authorized and anchored a system of oppression.

* * *

What social groups does communications technology bind? What groups escape or cannot be bound? What treaties are enforced in these settlements? What can we learn from examining such treaties?

Let us regard the history of communications technologies as an account of dissociation and integration — of the tensions between selves and bodies and the play of their interactions, separations and fusions. By mediating these interactions, communications technologies serve specific functions as creators and mediators of social/phantasmic consensual bodies, consensual spaces and consensual groups.

Social spaces and social groups do not spring into being only as concomitants of technology. Some workers study technologies as crystallizations of social networks, the technologies and the networks cocreating each other in an overlapping multiplicity of complex interactions. Technologies can be seen simultaneously as causes of, and responses to, social crisis. Consider the history of communication technologies as the study of social groups searching for ways to enact and to stabilize a sense of presence in increasingly diffuse and distributed networks of electronically mediated interaction, and thus also as ways to stabilize self/selves in shifting and unstable fields of power.

Let us consider bodies and selves in relation to communications technology in three ways:

First: As structures that mediate cultural legibility for the biological substrates to selves, substrates that legally authenticate political action; that is, as an apparatus for the production of body.

Second: As selves and relationships between selves constituted and mediated by technologies of communication; that is, as an apparatus for the production of community.

Third: As technologies mediating between bodies and selves, which may or may not be within physical proximity; that is, as interfaces.

Implicit in many of these accounts are assumptions about what bodies should be or do, what form bodies should take, and what conditions relationships between bodies and selves should require.

Over time, the relationship between bodies and their attendant "selves" has undergone a slow process of change. Strictly speaking, the classical bourgeois worldview, which incorporated a mechanistic view of the universe or nature and an egoistic view of "man" (with its implications for the ways in which body and self might be coupled under specific political and epistemological constraints), was a preeminent factor in the production of knowledge for a period of only about 150 years. Its influence began to be felt perhaps in the late 1600s, signaled, for example, by the publication of Newton's *Principia*; it ended around the 1840s about the time, for example, of the discovery of non-euclidean geometry and the development of critical psychology.

The subsequent deployment of knowledge structures — that is, the classical sciences, evolving under the primary influence of capital — was accompanied by improvements in systems of measurement in the realms of both the physical and the symbolic (as in cartography and psychology). In part, this was a complex expression of the political need to order the relationships between the emerging "subject" and its presumed associated body in ways that assured the maintenance of a social order that was already in dangerous disequilibrium. Social order, in this sense, implied spatial accountability — that is, knowing where the subject under the law was.

Traditionally, accountability referred to the physical body and most visibly took the form of laws that fixed the physical body within a juridical field whose fiduciary characteristics were precisely determined: the introduction of street addresses, passports, telephone numbers — in other words, the invention and deployment of documentations of citizenship in all their forms. This fine-tuned surveillance and control was developed in the interests of producing a more "stable," manageable citizen. The subtext of this activity is an elaboration and amplification of spatiality and presence — a hypertrophy of the perception of where, that is, what physics calls velocity and position.

The symmetry implied by the increasing precision with which both velocity and position could be determined in the macro- and microworld was ruptured in the 1920s and 1930s by the theoretical work of Niels Bohr and, later, Werner Heisenberg. The deep ontic unease that these proposals generated was perhaps not entirely different from the increasing preoccupation on the part of political apparatuses with precisely determining action and position in everything from satellite ranging to postal codes. Implicit in this elaboration of the concepts of spatiality and presence is the development of the fiduciary subject, in other words, a political, epistemological and biological unit that is not only measurable and quantifiable but also understood as being essentially in place. The individual social actor became fixed with respect to geographical coordinates that determine physical locus — a mode that ontically privileges the physical body (in an unusual invocation of a metaphysics of presence) rather than being located in a virtual system — that is, in relation to a social world of an information network, a social world whose primary mode of interaction is that of narrow-bandwidth symbolic exchange. In the context of this research, by "metaphysics of presence" I mean that a (living) body implies the presence within the body of a socially articulated self that is the true site of agency. It is this coupling, rather than the presence of the body alone, that privileges the body as the site of political authentication and political action.

* * *

On a high-resolution color computer screen appear images of a man and woman being married in an elaborate ceremony. They, their wedding party, a few presents and the surrounding landscape appear on the screen as detailed drawings, like a cartoon movie. Some of the guests appear to be animals, while others are invisible, signaling their presence by a small cloud at the top of the screen. Each bodylike form on the screen is an avatar, a body-representative for a physical person. The mainframe that makes their social interaction possible is located in Yokohama, but each person's physical body is seated at a terminal somewhere in the world; and the geography of the landscape that surrounds their wedding party is "elsewhere."

Many recent theorists view individuals' experiences of their own bodies as socially constructed — over and against other approaches that hold the body to be ontologically present to itself and to the experiences of the (always unitary) "self" inhabiting it. If we consider the physical map of the body and our experience of inhabiting it as socially mediated, then it should not be difficult to imagine the next step in a progression toward the social, to imagine the location of the self inhabiting the body as similarly socially mediated — not in the usual terms of position within a social field or of capacity to experience, but in terms of the physical location of a subject independent of the body, within a system of symbolic exchange — that is, information technology.

Theorizing a self in this way — in a spatiality of a different order, vectors different from those by which the body moves, a self moving in a spatiality from which the body is excluded — allows us to interpret the world of high-speed communications technology as a cultural framework within which social interaction can be understood as "normal" and can be studied in the same way as other social systems. Having said this, however, I must immediately add that interactions in virtual systems are, after all, a bit different. The chief difference is the effect of a changed density of the communication, the bandwidth.

* * *

"Bandwidth," as I use the term here, refers to the amount of information exchanged in unit time. "Reality" is wide-bandwidth, because people who communicate face to face in real time use multiple modes simultaneously — speech, gestures, facial expression, and so on. Certain critics have commented wryly that the current standard for bandwidth by which we judge visual communication is that of reality... a high bandwidth indeed. Computer conferencing is narrow bandwidth, because communication is restricted to lines of text on a screen.

The cultural history of communication is, in part, a history of exponentially increasing bandwidth. The effect of a narrowing bandwidth, then, is to engage more of the participants' interpretive faculties. This makes communication more difficult when we need the information conveyed precisely. On the other hand, for symbolic exchange originating at, and relating to, the surface of the body, narrowing the bandwidth has startling effects: a deep need to create extremely detailed images of the absent and invisible body, of human interaction and of the symbol-generating artifacts that are part of such interaction. Frequently, in narrow-bandwidth communication, the interpretive faculties of one or the other participants are powerfully, even obsessively, engaged.

A typical example of the extent to which participants in narrow-bandwidth communication engage their own interpretive faculties, and of the extent to which their interpretations are driven by engaging structures of desire, is indicated by studies of client-provider interactions in phone sex. Phone sex is the process of constructing desire through a single mode of communication, the human voice. The communication bandwidth between client and provider is further narrowed because the voices are passed through the telephone network, which not only reduces the audio bandwidth but also introduces relatively high levels of distortion.

Technically speaking, the effect of distortion on the intelligibility of the human voice has been thoroughly studied (as one might expect, mostly by the military in an effort to find standards of intelligibility for battle communications). These studies have shown that the human auditory system has an extremely wide tolerance for distortion and bandwidth limitation in voice communication. On the other hand, they have failed to note that even small amounts of distortion change interactive styles. It seems reasonable to speculate that these changes are caused by the participants' engaging their interpretive faculties in an effort to provide closure to a set of symbols perceived as incomplete. But closure in regard to what?

In phone sex, once the signifiers begin to "float" loose from their moorings in a particularized physical experience, the most powerful attractor becomes the client's idealized fantasy. In this circumstance, narrow bandwidth becomes a powerful asset because extremely complex fantasies can be generated from a small set of cues. In enacting such fantasies, participants draw on a repertoire of cultural codes to construct a scenario that compresses large amounts of information into a very small space. The provider verbally codes for gesture, appearance and proclivity, and expresses these as verbal tokens, sometimes compressing the token to no more than a single word. The client decompresses the tokens and constructs a dense, complex interactional image.

Because tokens in phone sex are presented only verbally, the client employs verbal cues to construct a multimodal object of desire, with attributes of shape, tactility, scent — in other words, all the attributes of physical presence — from his or her own experiential or phantasmic schema. This act is thoroughly individual and interpretive: from a compressed token of desire the client constitutes meaning that is dense, locally situated and socially particular.

Narrow-bandwidth interactions are useful in analyzing how participants construct desire, because the interactions are both real and schematized. While they cannot provide information about the vast and complex spectrum of human sexuality across societies, they do provide a laboratory that is large, moderately diverse and easily accessible for a detailed study of desire. But one need not engage in desire-mobilizing interactions to experience the attraction of virtual systems. An informant at an organization that tracks high-technology businesses reports that large public databases are experiencing difficulty in becoming profitable:

> What's happening is that users don't find the services, like online ticketing, electronic shopping and stock reports, very interesting. On the other hand, the online

conferences are jammed. What commercial online information services like Prodigy don't realize is that people are willing to pay money just to connect. Just for the opportunity to communicate.

* * *

Virtual systems imply particular understandings of space, time, proximity and agency. When we contrast the unease early users of the telephone felt — speaking "to" another person "through" the telephone — with easy familiarity with which early users of the computer seized upon computer conferencing, we can see that people have become comfortable with the idea that there are agencies — by which I mean politically authorized personae — on the other end of a wire, and indeed, eventually that it is unnecessary to be assured that there is an "other end."

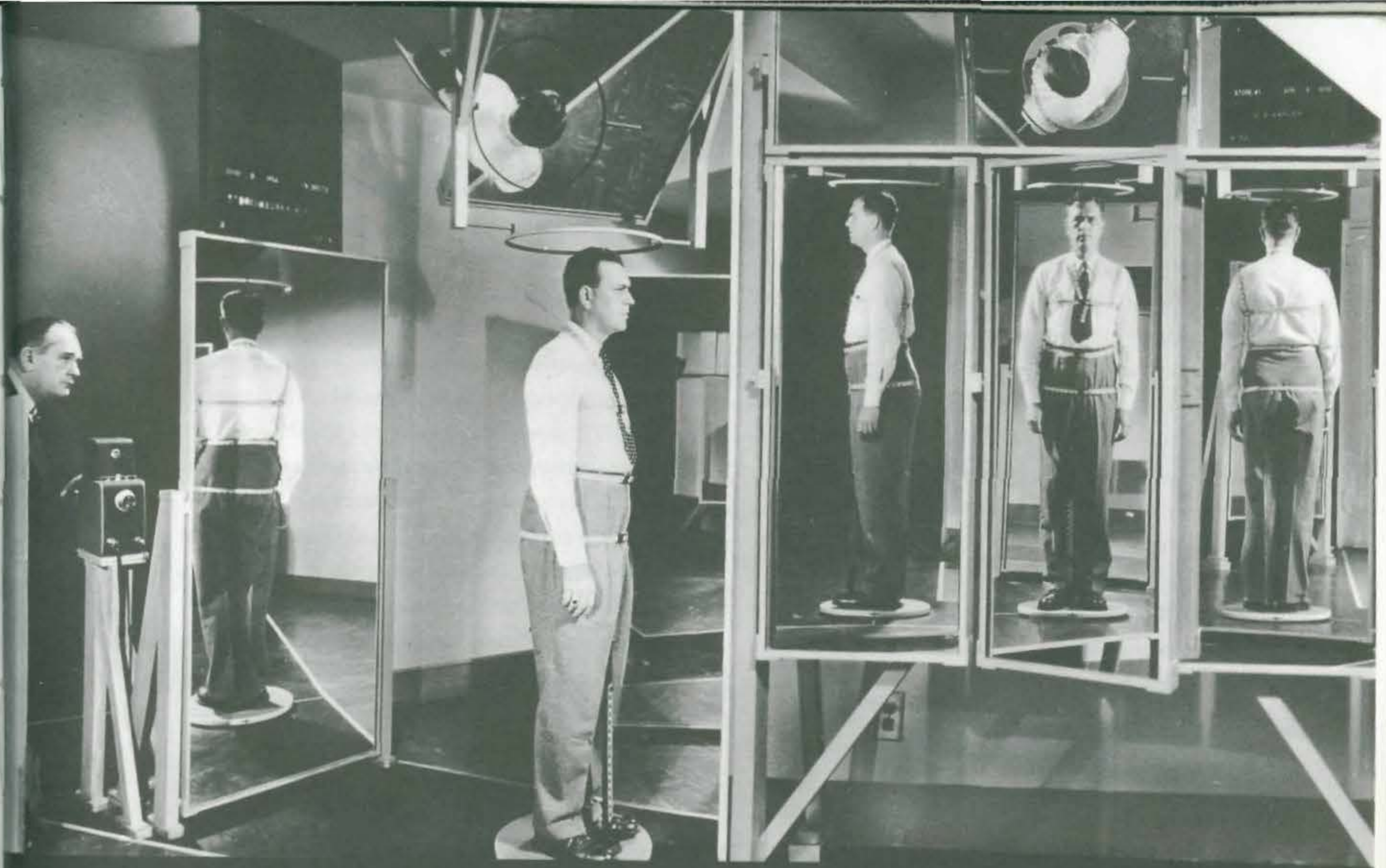
Prior to prosthetic communication, an agent maintained proximity through texts bearing the agent's seal, and the agency the texts implied could be enforced through human delegates; but in the era of electronic speech, proximity is maintained through technology, and agency becomes invisible. Users of the telephone eventually took for granted that they were speaking to another person "on" the telephone. It is this sense of assurance in the presence of a specific, bounded, unitary agency, grounded by a voice, that undergirded a gradual refiguration of the meaning of proximity. With the advent of electronically mediated speech, agency is grounded not by a voice but by an iconic representation of a voice compressed in bandwidth and volume as well as distorted by the limitations of the early carbon-granule transducers. It becomes something more than a signature or seal on a text but far less than an embodied physical vocalization. Agency is proximate when the authorizing body can be manifested through technological prosthetics. This, in turn, implies that as these prosthetics become *more complex, the relationship between agency and* authorizing body becomes more discursive.

While there are bodies produced in virtual systems, physically they are isolated bodies (though within a refigured phantasmic public space, one needs to redefine "public" and "private"). The interactions of the virtual body within fields of power is complex; uncoupled, the subject produced in these stories is multiple, ungrounded, and it is constituted through technologies of communication.

In this regard, I have been conducting a study of two groups who seemed to instantiate productive aspects of this idea. One is phone sex workers, the other is computer scientists and engineers working on Virtual Reality (VR) systems that involve making humans visible in virtual space. I was interested in the ways in which these groups, which seem quite different, are similar. The work of both is about representing the human body through limited communication channels: both groups code cultural expectations as tokens of meaning.

Computer engineers are fascinated by VR because they not only program a world but somehow inhabit it; and virtual worlds can be inhabited by communities. Thus, in the process of articulating a virtual system, VR engineers make templates for communities (as with George Lucas's Habitat); and because communities are inhabited by bodies, VR engineers model bodies as well. Although cheap and practical systems are years away, many workers are debating the form and character of the communities they believe will spring up in their quasi-imaginary cyberspace. In doing so, they are articulating their own assumptions about bodies and sociality and projecting them onto the codes that define cyberspace systems. For example, since programmers, in interaction with workers in widely diverse fields, create the codes by which VR is generated, how these heterogeneous groups understand cognition, community and bodies will determine the nature of cognition, community, and bodies in VR.

Bodies in VR are constituted by descriptive codes that "embody" expectations of appearance. Many of the engineers currently debating the form and nature of cyberspace are young men in their late teens and *twenties, and they are at times preoccupied with the* things that have always preoccupied the postpubescent. This group will generate the codes and descriptors by which bodies in cyberspace are represented. Because of practical limitations, some of their discussion is concerned with data compression and tokenization; but as



A salesman demonstrates camera designed to aid tailors in making better and quicker fits. 1948.

with phone sex, VR is a relatively narrow-bandwidth representational medium, visual instead of aural, and the ways bodies will be represented will involve the mechanisms of recognition.

One of the most active sites for speculation about how recognition might work in cyberspace is the work of computer game developers, particularly in the area known as interactive fantasy (IF). Workers in (and critics of) interactive fantasy have been speculating about how it will be deployed in VR scenarios. For example, how people will make love in cyberspace — a space in which everything, including bodies, exists as a metaphor, is coded.

* * *

Using this necessarily brief account as background, I want to use studies of virtual systems as an entry point for understanding the prosthetic quality of electronic communication and to search for apparatuses for the production of community and of body. I do not intend to present a detailed analysis here, but rather to show some of the things I treat at length elsewhere.

First: Members of prosthetic virtual communities act as if the community met in a physical public space. The number of times that online conferencees refer to the conference as a place is overwhelming: "This is a nice place to get together" or "This is a convenient place to meet." This sense increases with time, as online multiple-user environments describe inhabitable spaces in increasingly complex ways. For example, an experimental environment (MUD) at Xerox consists of a multi-roomed house and surrounding grounds, the appearance and character of which are described in considerable detail. A visitor "hears" the conversations taking place among other inhabitants nearby.

Second: Virtual space is most frequently visualized as Cartesian. Online conferencees tend to visualize the conference system as a simple three-dimensional space; some branches of the conference are "higher up" and others "lower down." In multiple-user environments this quality is explicit. This virtual space is frequently laid out with respect to the cardinal compass points: directions are expressed as east, west, north, south, and in some systems as up and down; others will use left, right, forward and back.

Third: Conferencees act as if the virtual space were inhabited by bodies. Conferencees construct bodies online by describing them, either spontaneously or in response to questions, and articulate their discourses around the assumed presence of bodies.

Fourth: Bodies in virtual space have complex erotic components. As in "real" life, conferencees place a high value on unambiguously identifying the gender of their fellow conferencees. Having made this determination, they frequently flirt with each other. Some may engage in "netsex," constructing elaborate erotic mutual fantasies. Erotic possibilities for the virtual body are a significant part of the discussions of some of the groups designing cyberspace systems. The consequences of virtual bodies are considerable in the local frame, in that conferencees mobilize significant erotic tension in relation to their virtual bodies. In contrast to the conferences, the bandwidth for physicalities in phone sex is quite limited. One worker said ironically, "On the phone, every female sex worker is white, five feet four, and has red hair." It is significant that almost without exception a binary gender system is ontologized in virtual space; there have been a few experiments in creating alternative gender constructs, but so far participants have not shown a high level of sophistication at doing so.

Fifth: The meaning of locality and privacy is not settled. The legal status of communication within the networks is a subject for continual debate. One ongoing problem is the meaning of inside and outside. Traditionally, when sending a letter one ensures privacy by enclosing it in an envelope. But in electronic mail, for example, the message is part of the address. The design of electronic mail systems erases the distinction of inside and outside, together with the idea of privacy — although no one has given up on encryption. A side effect of encryption will be to enable those engaged in electronic communication to reinstate the inside-outside dichotomy, and with it the notion of privacy in the virtual social space. Some early conferences experimented with private "areas" in which conversation was restricted to specific individuals, but to be truly private those areas had to be off-limits to the system operator as well — a situation that led to problems for the system as a whole. This is another example of how the evolution of virtual systems discloses many typical problems of emergent social order, as well as many of the same conflicts between the interests of the individual and the group, as do "real" social systems.

Sixth: Names are local labels. Conferencees (or their avatars that is, their delegated virtual personae) develop satisfyingly complex relationships with other conferencees. These remain stable through considerable variation in frequency and quality of interaction, including when one or another of the conferencees decides to change names. Conferencees may have several avatars, with a separate constructed personality for each, and move between them. These may sometimes be on the same conference. For friends who may know more than one avatar there is an intriguing persistence of identity — they treat the new avatar as as if it were still partly the old one. Which characteristics are most likely to persist is still under study.

* * *

The situation of women vis-à-vis technology in the "real" world — that is, the relatively fewer numbers of women who have had the encouragement or opportunity to deeply engage with complex computer systems, or who have found their way into top jobs in the high-technology industries — is mirrored in virtual systems, in which the participants are more likely to be male. This may be due to the ways that men and women are taught to respond to the sign of power. The sense of power that the ability to interactively influence the simulation provides is itself gendered, and may help to explain the gender imbalance among participants. In psychoanalytic terms, power for the young male is first associated with the mother figure. The experience of power that the mother figure represents is fraught with an unresolvable need for reconciliation with an always absent structure of personality, and it is the peculiar quality of the interface itself to mimic the same structure. As Sherry Turkle first suggested, an "absent structure of personality" is also another way of describing the peculiarly seductive character of that vague but palpable sentience, the computer. Turkle characterizes this aspect of computer interaction as producing the quasi-personality complex that she calls the "second self." Danger, the sense of threat as well as seductiveness which the computer can evoke, comes from both within and without. It derives from the complex interrelationships between human and computer, and thus partially from within the human; and it exists partially within the simulation. It simultaneously constitutes erotic pleasure and a sense of loss of control over the body. This mobilizes a constellation of responses to the simulation which deeply engage fear, pleasure, and also, perhaps, the simultaneous desire for and possibility of control. This experience has a protean character. The quality of mutability that virtual interaction promises is expressed as a sense of dizzying, exciting physical movement occurring within a phantasmic space — again an experimental mode psychoanalytically linked to primal experiences. It is no wonder, then, that inhabitants of virtual systems seem to experience a sense of longing for a space that is simultaneously embodied and imaginary, such as cyberspace suggests. This longing is frequently accompanied by a desire, inarticulately expressed, to penetrate the interface and merge with the system — what I have humorously referred to elsewhere as "cyborg envy."

The origin of the warranted self, safe in its politically authorized coupling with a biological body, is linked to the cultural production of bourgeois modernity. At the close of the twentieth century this linkage is dissolving, and the bounded social individual is engaged, willfully or otherwise, in a process of translation to the refigured and reinscribed agencies of virtual systems. "Sex and death among the disembodied" is an apt expression for the generous permeability of boundaries between the biological and symbolic, which this translation signifies. But as with everything else in the postmodern, the meanings of both sex and death have undergone translation. Sexuality refers to desire, but virtual desire is figured in terms of bandwidth and internal difference, leading to unexpected results. Death has many meanings, politically and personally. The personal body dies, coterminously with the juridically warranted subject. But the avatar within the virtual system does not die: it decouples — an act with an unsettlingly spiritual resonance.

Virtual systems and the social worlds they imply are examples of the flexible and lively adaptations that persons seeking community are beginning to explore. These new kinds of communities are part of a range of innovative solutions to the need for social interaction — a need that is frequently thwarted by the geographical and cultural realities of modern cities. Increasingly structured according to the needs of powerful economic interests, rather than in ways that encourage and facilitate habitation and social interaction in the urban context, the modern city thwarts rather than fosters social space and social interaction. Virtual systems and the redefinitions of the social that they imply may prefigure a wide variety of complex and ingenious strategies for survival in what many critics term the urban wasteland. The deepened split between the physical realities and dangers of urban life and the phantasmic world of online sociality is a both hopeful and cautionary sign, a new opportunity and a flight from responsibility, a chance to circumvent a world that many see as out of control and also a way of avoiding a complex and dangerous role in reclaiming the world from the forces that threaten to destroy it. Because of the power and potential of virtual systems there is a temptation to think of them as easy fixes. We must be wary of this attitude even as it emerges, encouraged by some of the brightest of the advanced system designers. Whether virtual systems can sustain the depth and complexity necessary for durable social structures that can withstand time and disruptive circumstances as yet unknown, remains to be seen.

As virtual systems burgeon, it is critical to remember that decoupling the body from the subject is an act that is politically fraught. As we enter the era of electronic virtual systems we should be acutely aware of whose agendas we serve. At the close of an era of a particular definition of individuality, consciousness still remains firmly rooted in the physical; the bounded subject is a refractory construct, quite difficult to dislodge, and it remains the object of force in a time when political agencies are as enamored of force as they have been at any time past. Before we can allow ourselves to forget this, the decoupled subject must possess a different order of agency from that of the name of a "disappeared" Central American, called back to momentary life by a graffito on a public wall.

The imagery of cyberpunk authors, and of a few virtual world builders, echoes with images of purely phantasmic bodies, freed from the constraints that flesh imposes. They take for granted that the human body is "meat" — obsolete, as soon as consciousness itself can be uploaded into the network. This, too, has unsettling religious resonances. Because of the ways that power works, it is important to remember that forgetting about the body is an old Cartesian trick, one that exacts a price from those bodies rendered invisible by the act of forgetting — those on the lower end of the social scale by whose labor the act of forgetting is made possible. Remembering the body may help us to prevent virtual systems from becoming unwitting accomplices in new exercises of social control. Remembering that bodies, selves, technologies and cultures constitute each other suggests a broad range of questions and unsettled debates from which to interrogate the burgeoning virtual communities.

Collective structures risking themselves in novel circumstances, reworking the structure of sociality, inventing a geography of elsewhere — and in the process, reinventing the links and tensions between bodies, selves, and communities. The alter-space within the vast electronic webs by means of which most of the symbolic exchange of the world already takes place is the first of many such elsewheres. This (un)real estate, supporting a different mode of existence from face-to-face sociality but nevertheless evincing a kind of tenacious Cartesianism that infects all attempts to describe it, is already home to thousands of communities whose impact outside the nets is only just beginning to be appreciated. The inhabitants of these virtual communities thoroughly internalize the Homo ludens mode of sociality — working from narrow-bandwidth cues, acting as if they inhabited common social territory.

The mode of interaction that this milieu fosters — congeries of personae whose greatest commonality is a single physical substrate in which they are loosely grounded, collective structures whose informing epistemology is multiplicity and reinvention — makes transformation as reflexive as it is transitive, and it is one of the "schizo" modes that Gilles Deleuze and Félix Guattari describe. Perhaps in virtual systems we can make out the lineaments of Coyote laughing at the metrics of classical physics by means of which science attempts to make and stabilize a world, collapsing and reinventing the terms by which spatiality, and consequently the ontology of articulating social spaces, is understood. It is not necessary to give up classical physics to step into the social world of virtual systems, but it is necessary to bracket it...that is, to open another reality window. This is social multitasking on the macro level — a mode we enter when we switch personae for each social world we enter — and to the extent that it is reflexive, it is an entry point to the dangerous multiple perspectival mode of Haraway's cyborg or the disruptive experiential bricolage of Deleuze and Guattari's schizo. It is both the challenge and the promise of virtual systems.

Nonorganic Life

Manuel DeLanda

According to Thomas Kuhn's well-known theory, scientific revolutions are triggered by a "paradigm-induced gestalt switch." A traditional way of conducting scientific research is replaced by a new one (a new paradigm is implemented), and scientists come to perceive phenomena that previously were "invisible." Kuhn gives the Copernican revolution as one example of such a shift. Unlike Chinese astronomers, who had been able to observe the occurrence of sunspots centuries before Galileo simply because their cosmological beliefs did not preclude celestial change, early Western astronomers were unable to "see" changes in the cosmos. Sunspots, for example, remained "invisible" — that is, insignificant and anomalous — until Copernicus's ideas changed the ways in which European astronomers could look at the heavens.[1]

The last thirty years have witnessed a similar paradigm shift in scientific research. In particular, a centuries-old devotion to "conservative systems" (physical systems that, for all practical purposes, are isolated from their surroundings) is giving way to the realization that most systems in nature are subject to flows of matter and energy that continuously move through them. This apparently simple paradigm switch is, in turn, allowing us to discern phenomena that, a few decades ago, were, if they were noticed at all, dismissed as anomalies.

For example, when we approach systems as if they were conservative — that is, artificially isolate them (experimentally or analytically) from ambient fluxes of energy and matter — we are led to expect that these systems will eventually reach a point of steady-state equilibrium. However, when we acknowledge that these fluxes necessarily flow through the system, a new possibility emerges — a *dynamic* equilibrium. One of the most striking examples of this is the spontaneous assembly of a "chemical clock." In a "normal" chemical reaction, the interacting molecules simply collide randomly, transforming one another when the energy generated by their collisions passes a certain threshold. If we imagine the substances involved as, say, "red" and "blue," we would expect their random interactions to result in a "violet" mixture. Indeed, a conservative model would almost certainly preclude any other expectation.

Reality, however, is full of surprises: under certain conditions, some chemical reactions behave in a most counterintuitive way. The reactants, rather than reaching a steady-state equilibrium (a violet mixture), suddenly turn completely red, then blue, and back to red, according to a perfectly regular rhythm. In order to perform such a feat, the billions of interacting molecules must somehow act in concert, since only by coordinating their movements could they produce rhythmic motions with such precision. According to the old paradigm, this spontaneous "cooperation" among molecules was so unlikely that, until very recently, it was thought to defy the laws of classical thermodynamics. Indeed, while the reign of the previous paradigm lasted, such chemical clocks were for all practical purposes invisible:

> [The chemical clock effect was] first reported in 1921 by William Bray, in the decomposition of hydrogen peroxide into water and oxygen, with an iodine catalyst. But chemists then believed — wrongly — that the laws of thermodynamics forbid oscillations. Instead of following up Bray's discovery, they concentrated on explaining it away, on the grounds that his experimental method must have been at fault — an attitude that set them back nearly forty years. In 1958 the Russian chemist B. P. Belousov observed periodic oscillations in the colour of a [chemical reaction]. Ilya Prigogine had by then shown that far from thermodynamic equilibrium, the usual laws of thermodynamics don't hold, and people were more prepared to take the results seriously.[2]

In a sense, we could say that the contributions of Prigogine and others have made visible this and other self-organizing chemical reactions. What were formerly rare phenomena, irritants to be explained away, began, under the new paradigm, to appear everywhere and in every form:

> Only a few years ago a chemical reaction was supposed to have a decent reaction order and not much more. But now, such a reaction is of low standing if it does not include a few of the following items among its properties: bifurcations, bistability, catastrophe, chaos, dissipative structures, echo waves, multistability oscillations, superchaos, symmetry breaks, trigger waves, etc. Our fascination with such phenomena in chemical systems is due to the fact that we believe they are the fundamental elements of dynamics which may integrate to form life.[3]

The spontaneous emergence of temporal patterns (chemical clocks) or spatial patterns (chemical waves and spirals) has many profound consequences for theories of evolution. These phenomena could elucidate how the right conditions for the emergence of life came about in the so-called primeval soup. Prigogine, for instance, calls attention to the special thermodynamic conditions necessary for the emergence of order out of chaos. At equilibrium, he says, matter is blind, but in these "far-from-equilibrium" conditions, as he calls them, it becomes capable of "perceiving" weak gravitational and magnetic fields.[4]

In other words, at the onset of a process of self-organization (when a chemical clock begins to assemble, for example), the mechanisms involved become extremely sensitive to minor fluctuations in the environment. A small change in external conditions, one that in thermodynamic equilibrium would have had negligible consequences — caused perhaps by a relatively weak gravitational or magnetic field — is amplified and directs the kind of chemical clock that is assembled (the period of its oscillations, for example), thereby "naturally selecting" one self-assembly pattern over another. Thus, because of their extreme sensitivity to initial conditions, spontaneously emerging chemical patterns in the primeval soup could have become beneficiaries of the pruning process of a prebiotic natural selection.

This idea has been developed by Peter Decker, a German researcher of self-organizing phenomena. Decker calls any chemical system sensitive to small fluctuations during its self-assembly a "bioid," which he defines as an open system capable of generalized Darwinian evolution. Unlike the chemical reactions used by Prigogine as examples of self-organization, which have been criticized for the rather artificial conditions under which they occur,[5] Decker's could have *actually* occurred in certain reactions that were present in the primeval atmospheric conditions on Earth. The onset of one such reaction (the formal reaction) and the self-organizing processes to which it might have given rise represent, according to Decker, the acquisition of the very first bit of evolutionary information on the planet.[6]

Of course, the kind of information that may be generated by chemical oscillations is rather meager and repetitive when compared with even the most primitive organisms. Yet, according to other recent findings, the same systems that pulsate regularly under some conditions are, under other conditions, capable of oscillating in extremely intricate patterns. Because these patterns make the behavior of the chemical system essentially unpredictable, they have often been described as "chaotic." For our purposes, what matters is that these chaotic oscillations, under the right conditions, could have generated the complexity we observe in the living world. Prigogine, for example, invites us to imagine a chaotic chemical reaction in which, at certain points, some of the chemicals precipitate or diffuse outside the reaction space. If we also imagine that these chemicals accumulate on a "tape" — some kind of natural storage device, like a self-replicating macromolecule — the spatial patterns generated will be as asymmetric and information-rich as those we observe in organic life.[7]

Another class of self-organizing phenomena, very different from those just discussed but also instrumental in reshaping how we understand the richness of expression of the material world, is called "solitary waves." Differing from ordinary waves in that they do not quickly dissipate as they move, they maintain their shape for a relatively long period of time. When, as happens, a solitary wave maintains its exact identity after interacting with other waves, it becomes a "soliton."[8] As with chemical oscillations, various forms of this phenomenon have been observed for a long time — over a century and a half — but they were relegated to the realm of anomalies. The first person to study these phenomena was John Scott Russell, a Scottish engineer and ship designer. In 1834, he witnessed the spontaneous emergence of a soliton in the surface of a canal near Edinburgh, and after chasing the coherent mass of water for several miles, he became convinced he had seen something extremely important. But science was not ready for this discovery, even though a mathematical explanation for it was available as early as 1892 (the Kortweg–de Vries equation).[9] As the components of a new scientific paradigm began to consolidate in the 1960s, solitons were recognized everywhere. In the ocean, for instance, they are called "tsunamis":

> Tsunamis are formed when a strong seismic shock occurs in the ocean floor. The wave, only a few inches or feet high, can travel intact across the ocean for many thousands of miles.... The human problem begins when the tsunami reaches the continental shelf. In shallower waters, nonlinear effects at the sea bed act to shorten the wavelength of the wave and increase its height. The result is awesome. From a soliton a few inches or feet high, the tsunami becomes a 100-foot mountain of water crashing into coasts and harbors. The tsunami that killed thousands in Lisbon in 1775 caused many writers in the age of Enlightenment to question the existence of a benevolent God. In 1702 a tsunami in Japan drowned over 100,000 people, and in the seismic soliton created by the volcanic explosion of Krakatoa Island in 1882 thousands died.[10]

Solitons can occur at much greater scales than tsunamis. In the atmosphere of Jupiter, for instance, there exists a soliton (the famous Red Eye) with a diameter roughly equal to the distance from the Earth to the Moon. On the other hand, solitons have also been found at extremely small scales: for example, this is the way in which electrons traveling through solid objects form charge-density waves. Indeed, *anything* that flows in regular waves (electricity, sound, heat, light) can give rise to solitons. Not surprisingly, the laws of classical thermodynamics would seem to forbid such coherent waves from arising spontaneously: if a given amount of energy is introduced into a flowing medium, the energy should diffuse evenly throughout the components of the medium. And indeed, this *does* normally happen; but in special circumstances, the energy can form into a pulselike wave and retain its coherent identity over time — and in some cases, even after collisions with other solitons.

Zinc oxide smoke.

Chemical clocks (periodic and chaotic) and solitons exist within our bodies. An important chemical reaction in our own metabolism, which serves to transform glucose into useful energy (glycolysis), has been shown to generate spontaneously rhythmic oscillations.[11] Chaotic oscillations, on the other hand, occur in neural activity associated with the control of the heartbeat and the secretion of some hormones. (Apparently, nonperiodic oscillations are more adaptable and flexible than rigidly periodic ones, lending them, perhaps, a functional advantage.[12]) Solitons, for their part, are helpful in understanding how energy is conveyed throughout the human body: since regular waves dissipate their energy too rapidly to be of any metabolic use, coherent pulses that maintain their identity could explain how energy produced in one part of the body fuels processes in another, distant part. Solitons traveling along the "backbone" of certain proteins could be the answer to this puzzle.[13] Similarly, electrical signals travel through the nervous system too fast to be accounted for by the traditional understanding of "incoherent" waves; thus, solitons have been proposed as the most likely mechanism for neural signal transmission, and in this regard they have been described as constituting the "elementary particles of thought."[14] In short, it seems that our bodies are inhabited as much by the phenomena of "nonorganic life" as by the more familiar phenomena of organic life.

Chaos and solitons have become the yin and yang of the new physics.[15] At one extreme, there are relatively simple systems (a chemical clock, a mechanical pendulum), which can generate bewilderingly complex behavior; at the other, there are extremely complicated systems (oceanic and atmospheric motion), which can generate simple and coherent structures (pulselike solitons, or more generally, fronts, shock waves and bubbles). When the two are combined — by adding "friction" to a soliton-bearing equation, for instance — the result is the formation and competition of spatial patterns of great complexity and beauty. Indeed, what the study of chaos and solitons was to the 1980s, the study of pattern formation may be to the 1990s.[16] What is important for our purposes, though, is that both periodic and nonperiodic oscillations and coherent structures are among the unexpected possible behaviors of "inert" matter, behaviors of which we have only recently become aware. Matter, it turns out, can "express" itself in complex and creative ways, and our awareness of this must be incorporated into any future materialist philosophy.

One may well wonder why it has taken so long for these material effects to be recognized. Of the many possible explanations, one undoubtedly deserves special mention: our "mathematical technology" was simply incapable of modeling self-organizing phenomena. The kind of equation most abundant in science (both classical and quantum), the "linear" equation, is extremely useful for modeling physical systems — *not so much because this mathematical form captures all the relevant* aspects of behavior, but because it provides a workable approximation, easily solved, and thus adequate in its predictive ability. Nonlinear equations, on the other hand, were not so easily solved, at least not before the advent of digital computers; even if they gave us a more realistic representation of reality, they were useless for practical applications. As a result, nonlinearities (like friction and air drag) were eliminated as much as possible from mathematical models, making nonlinear effects like chaos and solitons "invisible" (that is, visible only as anomalies to be eliminated). According to one mathematician:

> So docile are linear equations, that classical mathematicians were willing to *compromise their physics to get them. [Consequently,] the classical theory* deals with shallow waves, low-amplitude vibrations, small temperature gradients [that is, eliminates nonlinearities]. So ingrained became the linear habit that by the 1940's and 1950's many scientists and engineers knew little else.... Linearity is a trap. The behaviour of linear equations... is far from typical [in nature]. But if you decide that only linear equations are worth thinking about, self-censorship sets in.... Your textbooks fill with triumphs of linear analysis, its failures buried so deep that the graves go unmarked and the existence of the graves goes unremarked.[17]

Thus, one of the main causes of the paradigm shift that has allowed us to "see" matter as capable of self-organization is an advance in the *technology that materially supports mathematics, and with it mathe*matical technology. Needless to say, this will not be an overnight replacement, and much of science (classical and quantum) will remain linear. But nonlinear science has begun to reveal new and startling facts about matter, in particular, that the behavior of entirely different material systems can exhibit "universal features." Physicists, for example, have known for some time that phase transitions in matter (from liquid to solid, from magnetic to nonmagnetic, from conductor to superconductor) display a common mathematical structure despite the diversity of their actual physical mechanisms. More recently, it was found that the onset of turbulence in a flowing liquid (a self-organizing process) is *also closely related to such phase transitions, as well as to the onset of* coherence in laser light. In a very important sense, then, all these transitions may be said to be "mechanism independent": one and the same "mathematical mechanism" can account for all these events that would seem otherwise to be wholly unrelated.[18]

Similarly, the onset of rhythmic behavior in a chemical reaction is identical to many other processes in which equilibrium systems suddenly begin to oscillate — a well-documented example is the spontaneous aggregation of slime mold amoebas, in which one individual amoeba functions as a "clock" that regulates the assembly of other separate cells into one large multicellular organism. Nonlinear oscillations have been observed in fields as *diverse as electronics, economics and ecological* relations (such as predator–prey systems). Soliton phenomena, as we saw, occur at every scale, from Jupiter's Red Eye to tsunamis, to atomic charge-density waves, and in every kind of energy flow (heat, light, sound). This startling universality of the mathematics of self-organization is one of the most revolutionary elements of these new theories:

> "There is no better, there is no more open door by which you can enter into the study of natural philosophy," Michael Faraday has written, "than by considering the physical phenomena of a candle." Although the wisdom of this remark lay unrecognized for well over a century, it is now rather widely understood that the study of nonlinear diffusion in a candle... is closely related to the dynamics *of nerve impulse propagation, the spread of conta*gious disease, and the beating of the human heart.... The same equation that solid state physicists and electrical engineers use to describe the propagation of magnetic flux quanta (called "fluxons")... is also employed by theoretical physicists as a model for elementary particles. Similarly, the soliton on an optical fibre... is closely related to suggested mechanisms for the transport and storage of biological energy in protein.[19]

In mathematical terminology, the events at the onset of self-organization are called "bifurcations." Bifurcations are mutations that occur at critical points in the "balance of power" between physical forces — temperature, pressure, speed and so on — when new configurations become energetically *possible, and matter spontaneously adopts them.* It is as though "inert" matter, confronted with a problem stated in terms of a balance of forces, spontaneously generates a machinelike solution by drawing from a "reservoir" of abstract mathematical mechanisms. For instance, in the case of chemical self-organization, two distinct forces are at work: the rate at which the substances diffuse and the rate at which they react with each other. When the balance of power is dominated by diffusion, the result is a steady-state equilibrium, but the moment reaction rates begin to dominate, the chemical substances are suddenly confronted with a new problem, and they must respond to the challenge by adopting a configuration that meets the new energetic requirements. In this case, the *new stable solution to the problem is to* enter into an oscillatory equilibrium, and it is in this way that chemical clocks are born. But, again, more important than the self-assembly of these clocks is the fact that essentially the same solution is available to other systems, like populations of electronic circuits or of economic agents, which involve balances of power between forces of a completely different kind.

Gilles Deleuze and Félix Guattari have suggested that this abstract reservoir of machinelike solutions, common to physical systems as diverse as clouds, flames, rivers and even the phylogenetic lineages of living creatures, be called the "machinic phylum"[20] — a term that would indicate how nonlinear flows of matter and energy spontaneously generate machinelike assemblages when internal or external pressures reach a critical level, which only a very few abstract mechanisms can account for. In short, there is a single machinic phylum for *all* the different living and nonliving phylogenetic lineages.

The machinic phylum remained largely invisible until the advent of digital computers; or rather, considering how pervasive nonlinear behavior is throughout nature (it could hardly have escaped everyone's attention), we had to learn to recognize it.[21] Bifurcating sequences leading to complex behavior *had* been "observed" by mathematicians such as Henri Poincaré as early as the 1890s — although those early glimpses into the wild spaces of the machinic phylum horrified most who saw them. Those passing glimpses have, with the proliferation of computers in mathematical investigations (giving rise to "experimental mathematics"), opened onto vast landscapes — computer screens becoming our "windows" onto the machinic phylum in more than a figurative sense.

If computers have emerged as windows onto this world, it is because the nonlinear mathematical models of bifurcation processes can be given a visual representation, a "phase portrait." The first step in creating a phase portrait is to identify the relevant aspects of the behavior of the physical system to be modeled. It is impossible, for example, to model an oven by considering each and every atom of which it is composed, but one *can* consider the single aspect of the oven that matters: its temperature. Similarly, in modeling the behavior of a pendulum, only its velocity and position are important. In technical terms, the oven has "one degree of freedom," its change in temperature; the pendulum, in turn, has two degrees of freedom. A bicycle, on the other hand — taking into account the coordinated motion of its different parts (handlebars, front and back wheels, right and left pedals) — is a system with approximately ten degrees of freedom.

The next step is to create an abstract space (called "phase space") that has as many dimensions as the system to be modeled has degrees of freedom.[22] In this way, everything that matters about the system at any given moment in time can be condensed into a single point: a point in one-dimensional space (a line) for the oven, a point in two-dimensional space (a plane) for the pendulum or a point in ten-dimensional space for the bicycle. Moreover, as the system changes in time (the oven heats up or the bicycle makes a turn), this point in phase space will also change, thus describing a trajectory. This trajectory, in essence, will contain all the information that matters about the history of the modeled system. For example, if the system under study tends to oscillate between two extremes, like a driven pendulum, its trajectory in phase

Liquid crystals.

space will form a closed loop, which represents a system whose "movement" consists of a repetitive cycle. A free pendulum, on the other hand, which eventually comes to a standstill, appears in a phase portrait as a spiral. More complex systems will be represented by more complex trajectories in phase space.

Now, it is one thing to model a system with a set of equations, but quite another to solve those equations. Sometimes, when the equations modeling a system are so complex that they cannot be solved — that is, when they are nonlinear — scientists can nevertheless learn something about the system's behavior by looking at its phase portrait. They cannot make precise quantitative predictions about the system, but they can use the phase portrait to elicit qualitative insights about the general traits governing the system's long-term tendencies. In particular, there are certain special spots in phase space that tend to attract or repel all nearby trajectories; that is, regardless of where a trajectory begins, it will tend to drift toward certain points (called "attractors"), or to move away from certain others (called "repellors").

Because these trajectories represent the behavior of real physical systems, the attractors and repellors in a phase portrait represent the long-term tendencies of a system. For instance, a ball rolling downhill will always "seek" the lowest point. If it is pushed up a little, it will roll down to this lowest point again. Its phase portrait will contain a "point attractor": small fluctuations (the ball being pushed up a little) will move the trajectory (representing the ball) away from the attractor, but then the trajectory will naturally return to it. Other systems will have two point attractors or more. A well-made light switch, for example, whose resting states are "on" and "off," has two attractors — and if it is delicately set between them, chances are good that it will spontaneously snap into either position. Its phase portrait can't tell us *when* it will do so — that is, provide a precise quantitative prediction, which implies that the equation has been solved — but it can describe the system's long-term tendency to snap into one of its points of equilibrium. In fact, the specific form of the nonlinear equation modeling the system will reveal this before its specific trajectory has been calculated.

Attractors, though, do not necessarily appear as points. For example, an attractor with the shape of a closed loop (called a "periodic attractor" or "limit cycle") will force all trajectories passing nearby to wrap around it, to enter into an oscillating state, like a pendulum. If the phase portrait of a physical system has a periodic attractor embedded in it, we know that no matter how we manipulate the behavior of the system, it will tend toward an oscillation between two extremes.

These two attractors, points and closed loops, were the only types known before computer screens opened windows onto phase space. What followed was the discovery of a much wilder array of creatures inhabiting phase space: among them were attractors with strangely tangled shapes, called "strange" or "chaotic" attractors, representing turbulent behavior in nature, and the incredibly complex, chaotic boundaries separating "basins of attraction" (a simple attractor's sphere of influence in phase space). Far more startling, though, was the discovery that an attractor can spontaneously mutate into a different attractor. These spontaneous transformations are known as "bifurcations." For instance, a physical system that originally tended toward a steady-state equilibrium (a point attractor) can suddenly begin to oscillate between two extremes (a limit cycle); this would describe the self-assembly of a chemical clock. Spontaneous self-organization can take other forms as well: the onset of turbulence in a flowing liquid appears in phase space as a cascade of bifurcations that takes a circle (limit cycle) and, through successive doublings, transforms it into a strange attractor. Roughly, we could say that phenomena of self-organization occur whenever a bifurcation takes place: when a new attractor appears on the phase portrait of a system, or when the system's attractors mutate in kind.

We have, then, three distinct entities inhabiting phase space: specific trajectories (corresponding to systems in the actual world), attractors (corresponding to the long-term tendencies of these systems) and bifurcation events (corresponding to the emergence in these systems of new structural tendencies). Bifurcation events are brought about by changes in certain "control parameters," which represent the more or less constant conditions affecting physical objects; temperature, pressure, gravity and so on. As the value of a parameter shifts through certain ranges, the attractors of the physical system represented will usually change subtly; at certain critical points, though, a bifurcation will take place, and the attractors will transform themselves.

As I said earlier, because essentially the same attractors and bifurcations are available for many different physical systems, they may be seen as *virtual* or *abstract mechanisms* that are "incarnated" in different concrete physical mechanisms. This is not to say that attractors and bifurcations exist in some platonic realm waiting to be realized — rather, *they are intrinsic features of the dynamics of physical systems, and they have no independent existence outside of those physical systems.* Yet, attractors and bifurcations do constitute an abstract reservoir of resources available to nonlinear flows of matter and energy — a condition that applies as much to the beating of hearts as to earthquakes, flames and clouds, tsunamis and amoebas. And it is in this respect that I introduce the term "machinic phylum" to designate a single phylogenetic line cutting through *all* matter, "living" or "nonliving," a single source of spontaneous order for all of reality. More specifically, the attractors define the more or less stable and permanent features of this reality (its long-term tendencies), and bifurcations constitute its source of creativity and variability. Or to put it more philosophically, attractors are veritable "figures of destiny," for they define the future of many systems.

For instance, when the dynamics of a physical system are governed by a periodic attractor, it is as if the very flows of matter and energy rushing through the system were binding it, or destining it, to an oscillatory future. And yet, for several reasons, this iron-clad determinism should not be given too mechanistic an interpretation. For one thing, the phase portraits of most systems usually contain more than one attractor, which means that the system in question has a "choice" between several destinies. Then, there is the "freedom" built in to chaotic attractors. When a system's dynamics are caught in a strange attractor (deterministic chaos), that system is "bound to be creative," that is, to explore all the possibilities of a small region of phase space. Furthermore, even if we are destined to follow the attractors guiding our dynamical behavior, there are also bifurcations, critical points at which we may be able to change our destiny (that is, modify our long-term tendencies). And because minuscule fluctuations in the environment in which a bifurcation occurs may decide the exact nature of the resulting attractors, one can hardly conclude that all actions we undertake — as individuals or collectively — are irrelevant in the face of these deterministic forces. Bifurcations may not be a "guarantee of freedom," but they certainly do provide a means of experimenting with — and perhaps even modifying — our destinies:

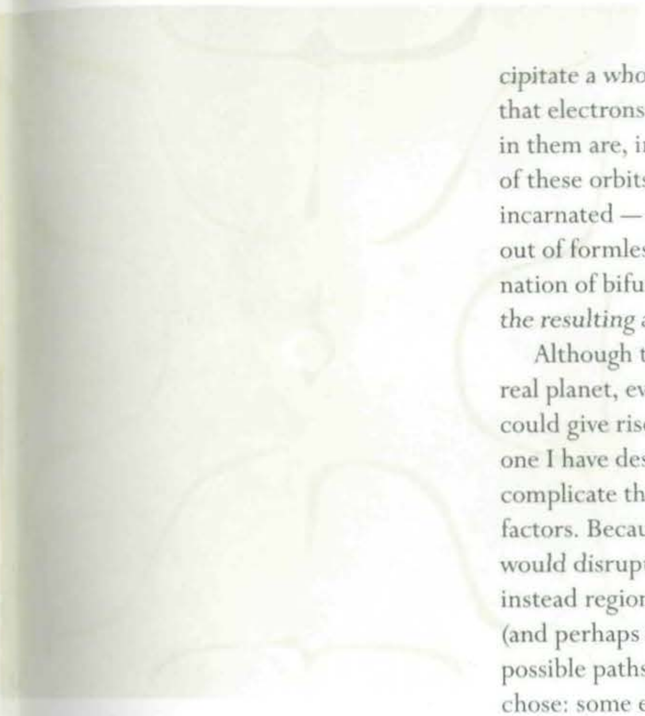
> From the physicist's point of view this involves a distinction between states of the system in which all individual initiative is doomed to insignificance on one hand, and on the other, bifurcation regions in which an individual, an idea, or a new behaviour can upset the global state. Even in those regions, amplification obviously does not occur with just any individual, idea, or behaviour, but only with those that are "dangerous" — that is, those that can exploit to their advantage the nonlinear relations guaranteeing the stability of the preceding regime. Thus we are led to conclude that the same nonlinearities may produce an order out of the chaos of elementary processes and still, under different circumstances, be responsible for the destruction of the same order, eventually producing a new coherence beyond another bifurcation.[23]

Although attractors and bifurcations appear *only* in the phase portraits of systems that are "dissipative" (those in which energy is not conserved), even conservative systems show a partitioning of phase space into regions, some of which define systemic long-term tendencies. Such a phase space may be seen as an "energy landscape," with peaks and valleys that correspond to maxima and minima of free energy. These valleys serve as attractors in the sense that these systems will spontaneously adopt a physical configuration that minimizes the amount of free energy — in other words, their trajectories will tend toward low-energy valleys. Despite the important distinction between dissipative and conservative systems, in both cases a feature of their phase portraits constitutes a "figure of destiny" — and for that reason, I shall simply refer to these as "attractors."[24]

A similarly important distinction exists between equilibrium and nonequilibrium phase transitions. Although the former — illustrated by the transition from gaseous to liquid or to solid states of matter — is a bifurcation that involves the generation of a new energy landscape in phase space, the latter case — the transition from calm ("laminar") to turbulent flow in fluids — involves the creation of a new set of attractors. Again, though, in *both* cases a critical point in the balance of power between physical forces brings about the alteration of the system's long-term tendencies — and so I shall refer to both as "bifurcations." A more complete theory of the machinic phylum would have to address these issues in detail, but this rough picture of the mathematics of self-organization will suffice for our purposes here: defining the concept of nonorganic life and the theories that connect it to our own organic bodies.

Let us consider a few hypothetical scenarios of how "reality" as we know it could emerge from the interplay of attractors and bifurcations — in other words, how more or less permanent physical structures (from organisms to entire planets) could be created by the machinic phylum, by the "mere" nonlinear flow of matter and energy. Let's begin with an impossibly simple case, that of a "crystal planet" made entirely of a single element. We can imagine this planet as it exists at the moment of its birth, that is, as it precipitates from a protostar, a ball of superhot plasma (which at a very high temperature is an electrically charged cloud of subatomic particles). As the plasma cools, it increasingly acquires form: atomic nuclei appear, then the naked nuclei acquire electrons, forming atoms, which then form molecules (precipitating a gas), which condenses into a liquid — from which, eventually, there crystallizes a solid, our planet.[25]

The plasma, at its highest temperature, may be regarded as formless — there are not even atomic nuclei, only flows of subatomic matter and energy. The *possible* bifurcations, on the other hand, the critical temperatures at which new forms arise, are already "there," in the sense that for any given element these points are very precisely defined. As the plasma crosses these temperature thresholds, these bifurcations are actualized.[26] The actualization of a bifurcation, as noted, involves the creation of new attractors (or of new energy landscapes), which define the stable configurations that the components of the plasma may adopt. These attractors, in turn, must be actualized for those configurations to become real. Thus, the naked atomic nuclei of the cooling plasma precipitate a whole set of *new* attractors, *which specify the virtual orbits* that electrons may occupy. The passing electrons that become trapped in them are, in a sense, actualizations of these virtual orbits. When all of these orbits are filled — that is, when all the attractors have been incarnated — the result is a stable form: an atom. Thus, form emerges out of formless matter, order emerges out of chaos, through the incarnation of bifurcations (critical temperatures) and the actualization of *the resulting attractors.*[27]



Chladni figure. Grains of fine sand settling on plate agitated by a sound wave.

Although this hypothetical crystal planet would hardly look like a real planet, even at this stage, the simple cooling process in the plasma could give rise to complex patterns. Control parameters, other than the one I have described (temperature) as driving the bifurcations, would complicate the emerging forms; pressure and volume are two obvious factors. Because these would vary over the surface of the planet, they would disrupt the formation of a homogeneous crystal, producing instead regions of gas, liquid and solid in different parts of the planet (and perhaps even areas where all three phases coexist). Moreover, the possible paths to solidification would depend on which element we chose: some elements (for example, silicon) have a "choice" of solidifying either as crystal (quartz) or as a glass (opal, an amorphous solid). The result that is actualized, the path taken, will depend on how fast the bifurcation is crossed in any given area: if the solidification is rapid (a process called "quenching"), the result will be a glass, but if it is slow ("annealing"), it will be a more or less perfect crystal.[28]

Obviously, a more realistic scenario would involve a planet made of more than a single element. This would allow a vast increase in complexity, even if we assume only a limited number of elements. (On Earth, only ninety-two elements occur naturally; others, like plutonium, are too unstable to occur spontaneously, although they can be created under laboratory conditions.) With this addition, new phase transitions are created, like those at the onset of chemical reactivity. In other words, the different elements will begin to interact and form new substances. Furthermore, the gas, liquid and solid phases of the materials may enter into complex mixtures called "colloids" — examples of which are a solid and a gas (an aerosol), a solid and a liquid (gel), or any other, more complex combination. The colloidal state of matter is indeed very common.[29]

Clearly, if we admit enough such additions to our original scenario, the result will be a more realistic planet. Any extra details we add will simply increase the number of possible bifurcations available to matter — as, for instance, the novel phase transitions of the colloid state (like the bizarre mutations from solid to liquid we observe in quicksand — a bifurcation actualized through a small shock). Yet the planet that would result from such a process would simply be a collage of states of matter interacting with one another. A *real* planet, on the other hand, has mountains, valleys and other geological formations. Were we to peer inside the mountains, for example, we would find folded layers of different types of stone. In short, we would observe a historical structure — *not* a collage of states of matter.

On Earth, the main historical process responsible for the formation of mountains and other structures, is called the "geological cycle." Briefly put: Erosion and weathering create the raw materials for the cycle (stones, pebbles, grains), which rivers, through a process known as "hydraulic sorting," sort out and deposit as sediment at the bottom of the ocean. The sediment already has a structure, since the sorting process causes matter to deposit in distinct layers. When these layers are buried under further deposits, they undergo a transformation: the pebbles and grains that form these layers are cemented together into sedimentary rock (for example, sandstone or limestone). When these rock layers are folded under the pressure of movements of the Earth's crust, mountains emerge — which are then sculpted by erosion, and so on ad infinitum.[30]

Self-organizing processes drive the geological cycle. The tectonic forces behind the burial and folding of sediment are driven by molten rock flowing up from beneath the crust in convection cells, a coherent flow arising after a temperature bifurcation, constituting a kind of self-assembled conveyor belt. The rivers that sort out the pebbles and grains that make up the layers of sediment, can be seen as self-organized "hydraulic computers." The dynamics of a river's flow at different points in its course are governed by different attractors, turbulent flow from strange attractors, and coherent pulses (solitons) from weaker forms of nonlinear stabilization. It is these different "regimes of flow" that give the river its capability of sorting raw materials by grain size, shape and even composition.[31] Finally, the processes of erosion and weathering also act as "filters" or "sieves," sorting out materials by their degree of stability. Mountains are worked over by these processes, removing those components that are not fully stable, and leaving behind those that are strongly locked into their attractors. (For this reason, granite, a highly stable crystalline configuration, is typically found on high ground.[32])

Thus, adding these historical processes changes our simple picture of the birth of a planet. Instead of a simple sequence of bifurcations taking us from a plasma to crystal, here the formation of hardened structures involves attractors and bifurcations engaged in more complex interactions. The self-organized machinic assemblages they create (conveyor belts, hydraulic computers) provide the labor needed to generate geological constructions in a two-step process: first, the raw materials are selected and sorted (sedimentation), then they are consolidated into permanent structures (cementation or hardening). Because the end result of these two operations is geological strata, this process of double articulation has been given the name of "stratification."[33]

According to Deleuze and Guattari, processes of stratification occur not only in the world of geology but in every sphere of reality. In other words, any sphere of reality — the hydrosphere, the biosphere and so on — can be defined in terms of flows of matter and energy and the reservoirs driving those flows. At any given point in time, portions of these flows will be involved in any number of actively self-organizing processes; other portions of the flows, however, will have sedimented or hardened into more or less stable structures. Thus, we can describe a given region of the planet at a given moment by specifying which of the three possible states of these flows predominates: freely self-organizing, loosely bound or rigidly bound. But because these states are neither irreversible nor exclusive, we can speak of various components in terms of the "degrees of stratification" they exhibit.

For instance, a rock may seem to us the archetypal example of permanence and stability, but when one takes the long view, even *rocks* flow: their atoms migrate along grain borders (self-diffusion), dislocation boundaries within grains move, cracks and fissures propagate. In this sense, the flow of rocks is very viscous; they constantly change, but at extremely slow speeds. Furthermore, under extreme heat and pressure, rocks may undergo a bifurcation (limestone, a sedimentary rock, metamorphoses into marble).[34] Alternatively, rock may be melted into lava and reincorporated into the convection flows driving plate tectonics. Stratification, then, is in no way a terminal state: free matter and energy stratify, and the stratified destratifies.

Moreover, hydrological strata (rain belts, ice caps, rivers), atmospheric strata (pressure systems, wind patterns) and organic strata (food chains, dominance hierarchies) can also be understood as complexes of matter and energy flows that are stratified to different degrees.

What we have, then, is a kind of "wisdom of the rocks," a way of listening to a creative, expressive flow of matter for guidance on how to work with our own organic strata.[35]

Organic stratification, which gives rise to our own bodies (among other things), unfolds through chemical reactivity — that is, the onset of a reaction transforming one set of substances into another. This, too, can be considered a phase transition because these reactions involve "activation thresholds," the minimum amounts of energy necessary for chemical processes to begin. The control parameters determining these processes, however, are by no means fixed: catalysts — substances capable of manipulating these activation thresholds without themselves being affected — can raise the thresholds or lower them, and in this way can either inhibit or enhance a reaction.

In a very literal sense, catalysts are the first form of matter that can affect directly the control parameters driving bifurcations, either preventing or accelerating their actualization. (More precisely, catalysts push systems away from their attractors and toward the border of their basin of attraction, where small fluctuations can push them into the domain of a different attraction.[36]) In some cases, a substance can catalyze its own production (autocatalysis); in others, two or more substances can "cooperate" with one another by catalyzing each other's reactions (cross-catalysis). Chemical clocks arise only in these kinds of reactions. Among all the elements, the most powerful catalysts are metals, and for this reason metals have been said to bear a privileged status in the machinic phylum:

> [W]hat metal and metallurgy bring to light is a life proper to matter, a vital state of matter as such, a material vitalism that doubtless exists everywhere but is ordinarily hidden or covered, rendered unrecognizable.... [M]etal is coextensive with the whole of matter, and the whole of matter to metallurgy. Even the waters, the grasses and varieties of wood, the animals are populated by salts or mineral elements. Not everything is metal, but metal is everywhere. Metal is the conductor of all matter. The machinic phylum is metallurgical, or at least has a metallic head, as its itinerant probe-head or guidance device.[37]

This special capability of catalysts to intervene in the dynamics of other processes is the necessary precondition for life to begin. Indeed, the catalysts involved in living processes, called "enzymes," are far more specific than metals in their dynamic effects, allowing for much more detailed control of chemical reactions. The instructions for building each enzyme are stored in DNA, and this allows particular enzyme "designs" to be not only inheritable, but also capable of being fine-tuned for specific functions through the action of natural selection. Because the translation of sequences of DNA into enzymes is itself an activity regulated by enzymes, we seem to have here a classic chicken-or-egg dilemma.

Recent theories of how a machine as complicated as DNA and its translation operations came to be assembled begin with networks of cooperating nucleic acids and enzymes. One suggested precursor, called a "hypercycle," might have been a self-replicating molecule (nucleic acid) coded to produce an enzyme that enhanced the production of a second nucleic acid, which, in turn, coded for an enzyme that enhanced the production of the first — a dynamical cross-catalytic system governed by attractors and subject to bifurcations.[38]

Such a cooperating network might have been the mechanism through which the machinic phylum gave rise to organic life. Organic strata, however, differ from geological strata in that they have enveloped within their sphere of operations the control parameters driving bifurcations. In the case of our hypothetical crystal planet, the forces determining the control parameters (temperature, pressure, volume) had not yet been integrated into, nor harnessed by, the mountains and rocks they gave rise to. The latter simply emerged as the flows of matter and energy underwent bifurcations, but these structures had little or no effect on which bifurcations occurred. With organic strata, on the other hand, the stratified structures — in particular, DNA — also drive the control parameters, and are thereby able to determine which bifurcations are actualized.

Cathode-ray ocilloscope pattern.

For our purposes, we can treat living systems as made of two kinds of components: those that function more or less independently of the rate and flow of matter and energy, and those that depend critically on these rates of flow (that is, on degrees of viscosity or stratification). The bifurcations of the latter occur only at critical points in the rate of flow of matter and energy, whereas the instructions stored as genetic information for the assembly of enzymes are completely stratified and rate independent. In this sense, DNA and its enzymes can be seen as a complex parallel computer regulating the relative "viscosities" of different flows so as to permit the actualization of certain bifurcations but not others. This is, in essence, the hypothesis proposed by philosopher Howard Patee, who calls information-based structures like DNA "symbol systems":

> [S]ymbol systems exist as rate-independent (nonintegrable) constraints.... [They do not] depend, within wide limits, on the rate of reading or writing, or on the rate of energy or matter flow in the symbol-manipulating hardware. On the other hand, the effect...of symbols functioning as instructions is exerted through the selective control of rates. For example, the rate of reading or translating a gene does not affect the determination of which protein is produced. However, the synthesis of the protein as instructed by the gene is accomplished through the selective control, by enzymes, of the rates of individual reactions.[39]

These separate roles played by DNA and nonlinear, self-organizing processes can perhaps be best illustrated by looking at the way in which the genetic information contained in a fertilized egg is slowly converted into a fully developed individual of a given species. This is the process known as "embryogenesis." Roughly speaking, during embryogenesis two kinds of processes occur: those mediated by DNA, thus subject to genetic control, and those governed by attractors and bifurcations, thus constrained but not created by genetic information.

An egg consists of a nucleus (containing genetic information) and cytoplasm. Traditionally, the latter was regarded simply as a source of energy and nutrients for the developing embryo, but it is now known to play a much more fundamental role. As a rule of thumb, we should look for manifestations of nonorganic life in those processes in the developing embryo where the nucleus is not involved *as a source of informational constraints*. This qualification is necessary because the nucleus may be involved in the emergence of bifurcations, though not by virtue of its genetic material. For example, its position in the egg can create an initial "polarity" between different zones of the egg. This initial polarity, established during the formation of the egg (oogenesis), has been found to constitute a fundamental source of asymmetry guiding the development of the first few stages in embryogenesis. Even when the genetic activity of the nucleus has been inhibited, an egg will undergo certain early bifurcations due to its global dynamics:

> Self-assembly during [the early stages of] embryonic development is not mediated by direct gene intervention. When all the transcriptions have been prevented [through the use of an inhibitor] the regular cleavage patterns are retained. However, the polarity of molecular organization of both the egg's cytoplasm and its nucleus (chromatic) are essential for normal development. Hence the main features of [early] embryogenesis — cell differentiation, induction, determination of pattern formation — all stem from the oogenetically originated, spatial distribution of preformed informational macromolecules. The initial condition of embryogenesis is oogenesis. The epigenetics of embryonic development is built on the topological self-organization and orientation of macromolecules of the total egg.[40]

In later stages of embryo development, the emergence of the patterns forming various organs and structures — an eye, a leg and so on — similarly involves events directly mediated by DNA and those resulting from the global dynamics of interacting cells. Historically, the study of embryogenesis has shifted in the importance attributed to each of these factors. A century ago, there were two main theories of embryogenesis: one positing that organs are somehow preformed in the egg, and another positing that organs arise out of the dynamics of development. The first approach held that, as an egg cell divides, each cell would contain half of the total organism and so on throughout the course of embryogenesis. This has, of course, been proven false, for the destiny of a cell is not rigidly predetermined but, rather, is *regulated* during development:

> The classical demonstration of [the phenomenon of regulation] was provided in the 1890s in H. Driesch's experiments on sea-urchin embryos. When one of the cells of a very young embryo at the two-celled stage was killed, the remaining cell gave rise not to half a sea-urchin, but to a small but complete sea-urchin. Similarly, small but complete organisms developed after the destruction of any one, two or three cells of embryos at the four-celled stage. Conversely, the fusion of two young sea-urchin embryos resulted in the development of one giant sea-urchin.[41]

Several hypotheses have been proposed to explain the regulation of cell differentiation, the process through which a group of essentially similar cells — for example, an egg after the first few divisions — gives rise to incredibly diverse tissues. Following the discovery of DNA, it was thought that differentiation was entirely genetic — that as cells differentiated, their DNA changed as well, guiding the development of various sets of proteins and enzymes for various cell types. It was found, however, that DNA remains essentially the same in cells of totally different types.

What, then, accounts for cell differentiation? One general hypothesis holds that during embryogenesis certain chemical patterns emerge and guide cells to produce specific proteins at specific times. There are, in fact, several theories about exactly how chemical patterns accomplish this task, which differ mainly in the importance they attribute to genetic information in the guidance of these processes. On the one hand, the "positional information" hypothesis asserts that simple gradients of chemical concentrations are interpreted by differentiating cells according to a very complex genetic code. On the other, the "prepattern" hypothesis asserts that chemical patterns are very complex, and the genetic code with which the cells interpret them is very simple.[42] Clearly, there is a trade-off here: the greater the complexity one attributes to a self-organizing chemical pattern, the less the genetic information one need postulate for its interpretation, and vice versa.

For a long time, the latter hypothesis was favored because a mechanism for spontaneously forming simple chemical patterns seemed much more likely than one for complex patterns. But, as I suggested at the beginning of this essay, this situation is changing rapidly: chemical reactions are now viewed as capable of undergoing several kinds of bifurcations that result in the self-assembling chemical clocks, traveling waves, spirals and other complex patterns previously thought impossible. So the hypothesis of a prepattern is becoming accepted more widely, and with it an increased role for nonorganic life in the creation of organic structures.[43]

Regulation and regeneration were what first prompted scientists to postulate forces in embryogenesis other than genetic information. At particular stages in the development of an embryo, groups of cells interact and thereby develop along specific paths. These paths, though, do not seem to be wholly determined by genetic control: if a group of cells in a developing embryo is transplanted from one region to another, they will develop, not into the structure emerging in the first area, but into the structure corresponding to the second. These stable paths of development that guide or "canalize" cell behavior have been called "chreods."[44] Confronted with such self-organizing phenomena, one scientist has felt the need to postulate the existence of physical forces unknown to ordinary physics, which are supposed to act in a nonenergetic way, independently of space and time.[45] I see no need, however, for postulating mysterious agents to account for chreods: the attractors guiding the global dynamics of interacting cells suffice to account for their canalized behavior, and the bifurcations arising in those dynamical interactions adequately account for the emergence of the attractors themselves. More specifically, the enzymes produced by the expression of genetic information enter into "chemical reaction networks" whose dynamics are guided by attractors. Each type of cell (bone, muscle, nerve) is now thought to arise from a different attractor, with the DNA simply pushing cells from one basin of attraction to another.[46] This description has the advantage of explaining the spontaneous emergence of new patterns by invoking only intrinsic features of the global dynamics of cell populations, without postulating additional forces with mysterious properties.

Roughly speaking, then, the belief that all embryological events involve direct genetic supervision is giving way to a new vision: the egg begins as an undifferentiated field that undergoes a series of bifurcations, each of which produces a new set of attractors that form the chreods guiding development until the next bifurcation. One scheme for classifying attractors and bifurcations, known as "catastrophe theory," presents a taxonomy of seven elementary morphogenetic (that is, form-producing) events. To each of these sets of attractors and bifurcations corresponds a different process of self-organization in cell groups: in the right conditions, these will tend spontaneously to form a pleat or a fold, a pocket, a spike or a furrow.[47]

The more self-organizing processes scientists discover, the smaller the domain of DNA's control appears to be. Rather than including a complete blueprint for the construction of an entire individual, DNA must include only enough constraints to harness self-organizing processes in the creation of the structures that characterize a particular species. Mathematical analysis has established (for now) that the attractors and bifurcations guiding these dynamics are relatively few in number, so organic processes of stratification are themselves constrained by dynamical forces. In other words, morphogenesis — for example, the spontaneous emergence of form in a relatively formless egg — is limited by the available attractors and bifurcations. Hence, DNA constraints can only operate within these limits. In the words of one biologist:

> There are several consequences of this view of morphogenesis. First, it is evident that morphology is generated in a hierarchical manner, from simple to complex, as bifurcations result in spatially ordered asymmetries and periodicities, and non-linearities give rise to fine local detail. Since there is a limited set of simple broken symmetries and patterns that are possible (e.g., radial, bilateral, periodic), and since developing organisms must start off laying down these elements of spatial order, it follows that these basic forms will be most common among all species. On the other hand, the finer details of pattern will be most variable between species, since the pattern-generating process results in a combinatorial richness of terminal detail, and specific gene products in different species stabilize trajectories leading to one or another of these.... The fact that virtually all the basic organismic body plans were discovered and established during an early evolutionary period, the Cambrian, is often remarked with surprise, but it is just what one would expect on the basis of the above argument. "Ancient" and "recent" morphological characters are secondary consequences of the hierarchical nature of morphogenesis and the exploration of its potential in time.[48]

Crystal of virus.

The idea of an undifferentiated egg slowly developing into a full organism as it crosses bifurcations corresponds to our earlier image of a formless plasma giving rise to a crystal planet as it cools down and undergoes phase transitions. But as we saw before, we must also bring into play the action of historical processes of stratification in order to complete the picture. Like volcanoes in the lithosphere or hurricanes in the atmosphere, creatures in the biosphere must meet strict matter and energy budgets. The flow of flesh (biomass) through food chains constitutes the main form of energy circulation in organic strata — that is, energy budgets are met by all living creatures by eating and avoiding being eaten. In all ecosystems, planets are at the bottom of these food chains, constituting a reservoir of solar energy stored chemically (through photosynthesis). On top of this layer of primary productivity come several layers of consumers (herbivores, carnivores). The specific job that an animal or plant performs in an ecosystem (what is called its "niche") is defined by its position in one of these circuits for the circulation of biomass. So in this sense, organic strata are, like any other strata, composed of temporary coagulations of matter (the bodies of plants and animals), themselves the product of the ceaseless flow of energy through ecosystems.[49] And yet, animals and plants are unique in that they must also meet a second budget, a genetic budget that compels them to try to spread their genes as far and wide as possible. For these creatures, meeting their energy–matter budget is, in a sense, of secondary importance. They must eat and avoid being eaten only to endure until the mating season, when the main objective of their lives is revealed: the continuation of a genetic line, the preservation of the portion of the gene pool they encapsulate. The gene pool of a species may be seen as a veritable reservoir driving flows of genetic material through the bodies of its individual members. More specifically, a gene pool supplies the raw materials for the pruning process of natural selection. It contains the stored "experience" of the species over many generations, the "knowledge" of how to survive successfully in a given environment. Individual animals and plants are like temporary "experiments" with which gene pools probe current environmental conditions to make sure

zone

that past successes are still viable (in other words, that energy–matter budgets can still be met as before).[50]

Although gene pools are designed to replicate themselves very accurately (and thereby preserve past experience intact) random copy-error (mutations) and sexual shuffling of gene groups (recombination) generate enough variation so that these genetic reservoirs can respond to new environmental challenges. In short, thanks to variation, gene pools can evolve and be submitted to historical processes of stratification. Roughly speaking, mutation and recombination play the role of erosion and weathering — that is, they provide the raw materials for the sorting process of natural selection. In the simplest case, for example in the case of selection by climatic conditions, this process merely sorts out the fit from the unfit, or more generally, the stable from the unstable. And yet, like the hydraulic computers mentioned above, selection pressures are also patterned by nonlinearities. For instance, some pressures may add some directionality to evolution, as in the case of natural arms races: a thickening of the armor in a prey species directly provokes a sharpening of the claws and teeth in its predatory counterpart, which in turn puts pressure on armor designs to get even thicker. Similar catalytic loops occur between parasites and hosts, or between male decorations and female sexual choice.[51] In other cases, when the fitness of a particular trait or behavior is nonlinear (that is, when selection pressures depend on how frequent that behavior is exhibited in a population), behavioral patterns come to be stabilized by attractors (the so-called evolutionary stable strategies).[52]

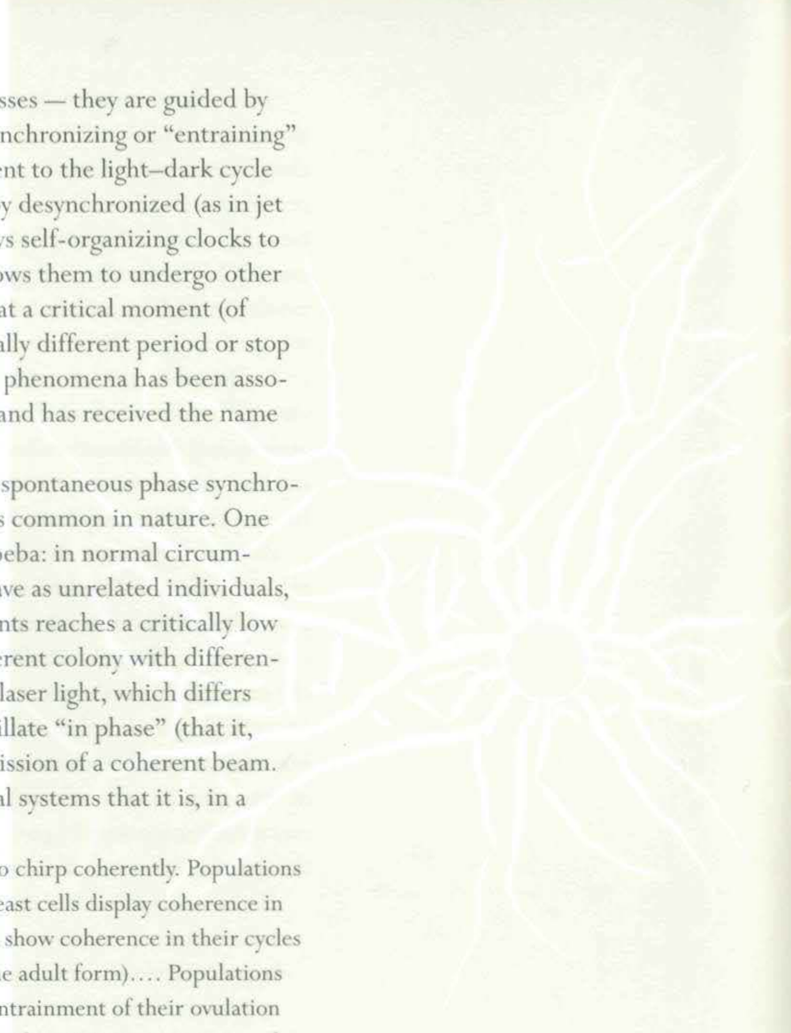
Thus, selection pressures of many kinds play the same role that processes of sedimentation perform in the case of rocks. They select the stable from the unstable, and then sort out what's left into the layers of a food chain. The analogy does not end there. Like patterns in the sedimentary deposits that form at the bottom of the ocean, the accumulated patterns of adaptive traits and behaviors brought about by natural selection are very ephemeral. They slowly sediment over many generations but they can be wiped out by a single large-scale bifurcation, like the onset of the ice age. So what then corresponds here to the process of cementing together loosely accumulated pebbles into hardened sedimentary rock? The answer, according to the discipline of macroevolutionary dynamics, is the process of "speciation," that is, the birth of a new species. When a portion of a population becomes reproductively isolated from its parent group, the information contained in its gene pool becomes permanently injected into the larger phylogenetic lineage to which both groups belong. Speciation acts like a ratchet, preventing accumulated adaptations from being eroded away. In this form, what was a loosely bonded set of anatomical and behavioral traits is now hardened into the more or less permanent structure of a particular species.[53]

Thus, the simple images of developing eggs and cooling plasmas, though good illustrations of the action of self-organizing processes, must always be complemented by a description of the actual historical processes of stratification that have determined how attractors and bifurcations have been actualized. These images are also misleading in another sense. On the one hand, eggs and plasmas are good metaphors for the machinic phylum, which I defined as a destratified, nonlinear flow of matter-energy. In both cases, matter and energy originally exist in a more or less formless state in which actual forms and structures exist only virtually as the various bifurcations that eggs and plasmas are capable of undergoing. On the other hand, these images could seduce us into thinking that the machinic phylum is something that exists only initially, and that it gradually disappears as concrete forms and structures emerge.

As the extreme example of limb regeneration indicates, though, the phylum does not "vanish" or become irrelevant in the aftermath of the system's early development. On the contrary, as with the nonorganic systems described above, the phylum remains immanent throughout the organism's development: it can be found whenever a process of self-organization occurs — whenever a phase transition takes place or an internal chemical reaction undergoes a bifurcation. Indeed, the dynamics of the complex networks of chemical reactions that make up our own metabolic processes are guided by bifurcations and attractors that guide the system between stable, or homeostatic, states:

> Homeostasis refers to the relative constancy of the internal environment with respect to variables such as blood sugar, blood gases, electrolytes, osmolarity, blood pressure, and pH. The physiological concept of homeostasis can be associated with the notion of steady states in mathematics. Steady states refer to a constant solution of a mathematical equation [a point attractor].... Although the mean blood pressure is maintained relatively constant, as we all know, the contractions of the heart are approximately periodic.... Likewise...with the rhythms of heartbeat, respiration, reproduction, and the normal sleep–awake cycle. Less obvious, but of equal physiological importance, are oscillations in numerous other systems — for example, release of insulin and luteinizing hormone, peristaltic waves in the intestine and ureters, electrical activity of the cortex and autonomic nervous system, and constrictions in peripheral blood vessels and the pupil. Physiological oscillations are associated with periodic solutions of mathematical equations [periodic attractors].[54]

Perhaps the best example of these processes is the internal physiological cycles involving waking, sleeping, temperature and so on, the so-called circadian rhythms. "Circadian," which literally means "about a day," refers to the fact that this internal rhythm has a period of roughly twenty-*five* hours. Consequently, as our internal "clock" adapts to the external day–night cycle, it undergoes a bifurcation every day. Because



our circadian rhythms are dynamical processes — they are guided by periodic attractors — they are capable of synchronizing or "entraining" to an external rhythm. Although entrainment to the light–dark cycle of the regular Earth day, for example, can by desynchronized (as in jet lag), the same dynamic flexibility that allows self-organizing clocks to adjust to the external environment also allows them to undergo other kinds of bifurcations. Thus, a flash of light at a critical moment (of bifurcation) can send one's clock into a totally different period or stop it altogether. A whole range of pathological phenomena has been associated with the occurrence of bifurcations and has received the name "dynamical diseases."[55]

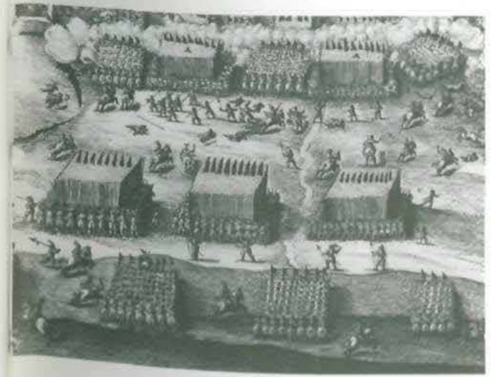
The phenomenon of entrainment — the spontaneous phase synchronization of different oscillating entities — is common in nature. One well-known example is the slime mold amoeba: in normal circumstances, a group of these amoebas will behave as unrelated individuals, but when the level of environmental nutrients reaches a critically low value, they assemble themselves into a coherent colony with differentiated "organs." Entrainment also occurs in laser light, which differs from ordinary light in that the photons oscillate "in phase" (that it, they are synchronized), resulting in the emission of a coherent beam. Entrainment takes place in so many physical systems that it is, in a sense, a mechanism-independent process:

> Populations of crickets entrain each other to chirp coherently. Populations of fireflies come to coherence in flashing. Yeast cells display coherence in glycolytic oscillation. Populations of insects show coherence in their cycles of eclosion (emergence from the pupal to the adult form).... Populations of women living together may show phase entrainment of their ovulation cycles. Populations of secretory cells, such as the pituitary, pancreas, and other organs, release their hormones in coherent pulses.[56]

In phase space, entrainment appears as a torus-shaped attractor, which the trajectories of different systems (the oscillating entities) come to wrap around. The transition from nonsynchronized to synchronized oscillations can be understood as a bifurcation in which a set of separate limit cycles transform themselves into a single attractor. Entrainment is common in living systems because periodic attractors are their main form of organization. Indeed, one crucial difference between geological and organic strata is the former's tendency to develop around points of static equilibrium (minima of energy, point attractors), as opposed *to the latter's tendency to make use of forms of dynamic equilibrium* (periodic and even chaotic attractors). Were one to track the flow of matter around the planet, one would see how it becomes stratified along these lines. For example, although the key element of life, carbon, is for the most part locked in rocks, some of it — notably in the form of carbon dioxide — moves freely through the biosphere; some of this, in turn, is trapped cyclically by plants (through photosynthesis), captured in their biomass and released when their leaves fall in autumn.

Dielectric in the process of breakdown.

Phalanx of soldiers.



There is a sense, then, in which we are all inhabited by processes of nonorganic life. We carry in our bodies a multiplicity of self-organizing processes of a definite physical and mathematical nature — a set of bifurcations and attractors that could be determined empirically, at least in principle. Yet, is there any way *to experience* this nonorganic life traversing us (for example, through the use of meditation techniques or psychedelic chemicals to "destratify" ourselves)?[57] As noted above, there *is* a "wisdom of the rocks" from which we can derive an ethics involving the notion that, ultimately, we too are flows of matter and energy (sunlight, oxygen, water, protein and so on). At any moment in these flows, we can distinguish some portions that are more viscous (hardened, stratified) than others. An ethics of everyday life, in these terms, would involve finding the relative viscosities of our flows, and giving some fluidity to hardened habits and making some fleeting ideas more viscous — in short, finding, through experimentation, the "right" consistency for our flows (the "right" mixture of rigid structures, supple structures and self-organizing processes).

Clearly, though, it is impossible to derive ethical lessons from the machinic phylum without considering processes of self-organization and stratification at the level of society. Animal and human societies, like individual organic bodies, are also "crossed" by the machinic phylum. For example, a particular population of animals is regulated by a simple equation concerning its birth and death rates and the reservoir of its environmental resources. This simple equation has been shown to undergo bifurcations: a population that for many years tended toward a steady-state equilibrium may suddenly begin to oscillate between two extremes. Similarly, the respective biomasses of two populations (one prey, the other predator) are also linked by equations susceptible to bifurcation.[58]

Elaborating on the observation that phase transitions and other bifurcations occur at the level of animal populations, Arthur Iberall has proposed a model of human society in terms that emphasize self-organizing processes. In his view, societies function as an ensemble of flows and the reservoirs driving those flows: water, metabolic energy, bonding pressures, action modes, population, trade, technology and so on. In doing so, Iberall is not out to replace standard accounts of human development but "to stress the role of flows and phase transitions in determining social field stability." He goes on to say:

> I view the discontinuous social change manifested by the appearance of food-producing societies (e.g., from hunting-gathering to horticulture to

> settled agriculture) as evidence of internal rearrangements, new associations and configurations, and a new phase condensation — as if a gaslike phase of matter were becoming liquidlike or solid state–like.... At his beginning, modern man apparently lived in hunting–gathering groups operating in a range appropriate to human size and metabolism.... If, as is appropriate to his size, man had the typical mammalian metabolism and roaming range of about 25 miles/day, cultures separated on the order of 50 miles would have little interaction.... The 70- to 100-mile separation of populations, as empirically found, is highly suggestive of a system of weak force, "gaslike" interactions.... [D]ecreases in the levels of the required potentials (temperature, water, food) cause condensation [liquification] of small bands on fixed centers of population.... The nature of the social phase condensation, however, depends on the amplifying capability of the technological potential. Associated with those two chief potentials — water supply and technology (tools) — came changes in modes of living, improvement in the use of water resources, and localized social development through the domestication of plants and animals....[59]

Eventually, these "fluidlike" social formations "crystallized" into stratified civilizations. Based on the archaeological record, Iberall concludes,

> civilizations began when there was extensive trade (convective flow) among population concentrations (condensations). The urban centers held cumulative populations greater than 2500 and were composite groups. The threshold size can be estimated from the absence of complex cultures of smaller population.[60]

This picture of social evolution corresponds in many ways to the creation scenario of our hypothetical crystal planet. Clearly though, if a simple liquid solution can harden into crystal or glass, ice or snowflake, depending on the multiplicity of nonlinearities shaping the solidification process, human societies — which have a wider range of attractor types — have far more leeway in how they develop stable configurations. And while there is much to be learned from analyzing in detail the actual processes of stratification and destratification that have occurred in different societies at different times, even a picture as simple as this already points to certain principles of a "geological ethics." Notably, society cannot be understood as climbing a ladder of "progress," as though hunter–gatherers, agriculturalists and "civilized" communities were stages on a path toward ever-increasing perfection. Rather, understanding these transformations as phase transitions would imply that a State apparatus is not essentially better than a "primitive" society, since after all, there is nothing intrinsically better about a solid than a liquid.

From the viewpoint of a geological ethics, early societies may even have achieved a better consistency among their flows, a viscosity more in tune with their ecosystems than our own. Indeed, it seems that some early societies may have sensed the approach of social solidification and developed mechanisms to prevent actualizing such a bifurcation.[61] This, of course, is not to say that we should return to some lost paradise of a "savage state," a bygone era of greater innocence and harmony. Rather, we must work on the society in which we find ourselves, tracking the flows of matter and energy, destratifying hardened institutions, setting into flux human practices that have sedimented — in short, we must find the right viscosity for our fluxes, the exact consistency that would allow humanity to self-organize without the need for coercion and war.

Iberall pictures the flow of goods along trade routes as an example of convective flow, as though precapitalist markets were indeed self-organizing structures creating order out of chaos. We may have to discover in the history and present of human practices those institutions that realize best the workings of the machinic phylum, or, more precisely, the degrees of stratification of each of its components: those flowing more or less freely, those sedimented into more or less supple structures and those rigidified into permanent institutions (entrenched political hierarchies, inflexible belief systems). The geological strata teach us that even the seemingly most rigid structures can flow (however slowly), mutate (metamorphic rocks) or even be reincorporated into self-organizing processes (convection flows of lava).

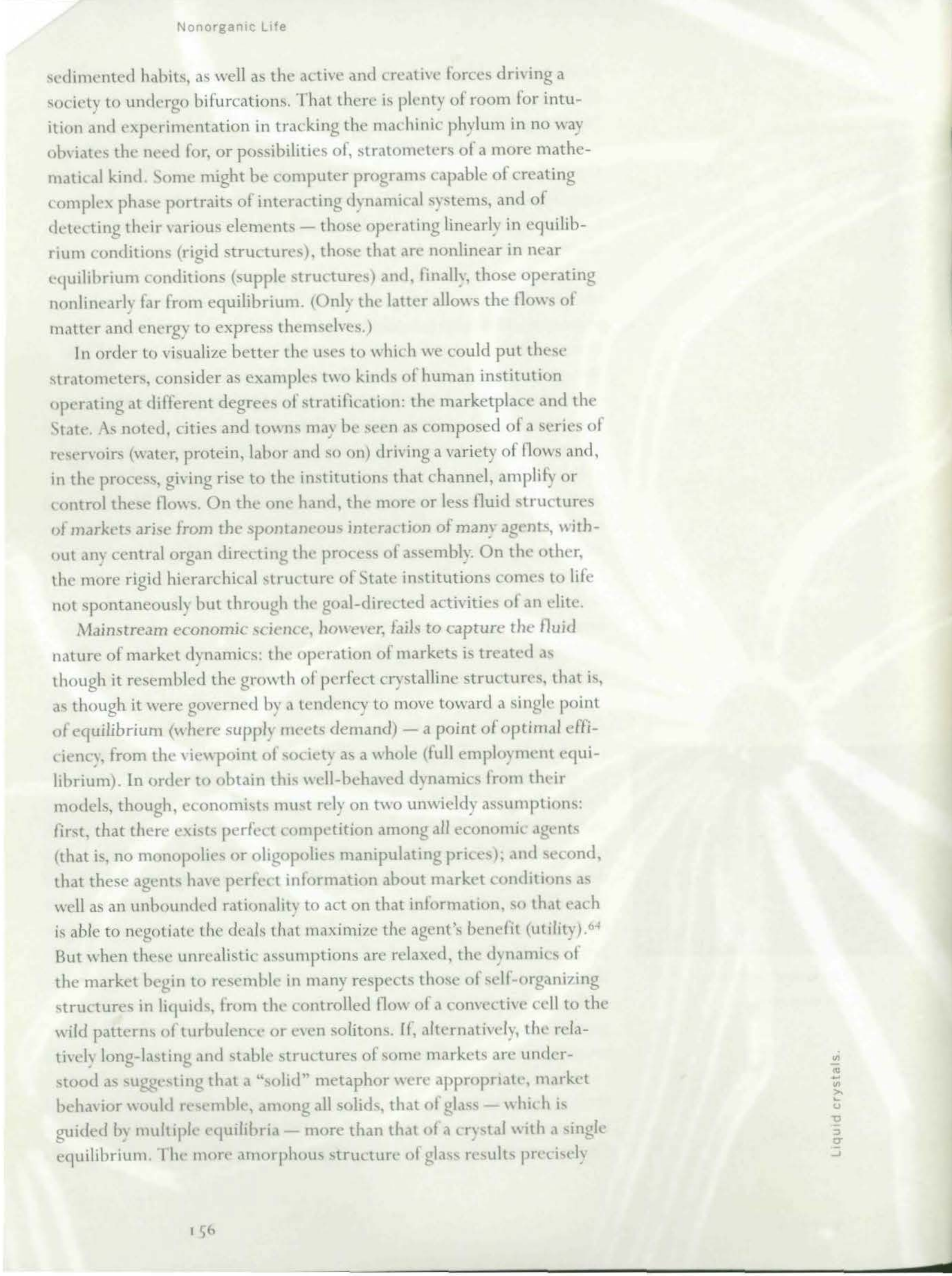
Part of such an effort would involve creating "maps" showing the attractors that govern the dynamical behavior of social flows, and more important, the bifurcation regions where — to paraphrase Prigogine — a "dangerous idea" can amplify itself by taking advantage of the nonlinearities that guarantee the stability of a given social system. The work of Deleuze and Guattari is exemplary for the creation of such maps: they show how our lives may be viewed as a composite of rigid structures (family, school, military service, office, marriage), supple structures (temporary alliances, transitory love affairs, loosely knit groups) and, finally, "lines of flight," the bifurcations that could allow us to change our destinies as defined by those two types of structures.[62] In every area of human reality (art, politics, love), they attempt to "measure" the degrees of stratification of the flows of matter and energy at work in these domains. For example, after showing how music originates from the expressive powers of matter itself (in particular, the self-organizing processes of animal territories that give rise to bird songs), they argue that music has a greater capacity to "destratify" than does painting. It is as though the modulated flows of air that we experience as music have a greater capacity to set our emotions and thoughts into flux than do the more viscous, spatial flows of form and color found in painting.[63]

Marching formation
at Nazi rally.

It follows, then, that the kind of "stratometers" that could perform these measurements of relative viscosity in various material and energy flows need not all be mathematically based. A great novel can, for a given society, capture the coexistence and interactions of rigid structures and sedimented habits, as well as the active and creative forces driving a society to undergo bifurcations. That there is plenty of room for intuition and experimentation in tracking the machinic phylum in no way obviates the need for, or possibilities of, stratometers of a more mathematical kind. Some might be computer programs capable of creating complex phase portraits of interacting dynamical systems, and of detecting their various elements — those operating linearly in equilibrium conditions (rigid structures), those that are nonlinear in near equilibrium conditions (supple structures) and, finally, those operating nonlinearly far from equilibrium. (Only the latter allows the flows of matter and energy to express themselves.)

In order to visualize better the uses to which we could put these stratometers, consider as examples two kinds of human institution operating at different degrees of stratification: the marketplace and the State. As noted, cities and towns may be seen as composed of a series of reservoirs (water, protein, labor and so on) driving a variety of flows and, in the process, giving rise to the institutions that channel, amplify or control these flows. On the one hand, the more or less fluid structures of markets arise from the spontaneous interaction of many agents, without any central organ directing the process of assembly. On the other, the more rigid hierarchical structure of State institutions comes to life not spontaneously but through the goal-directed activities of an elite.

Mainstream economic science, however, fails to capture the fluid nature of market dynamics: the operation of markets is treated as though it resembled the growth of perfect crystalline structures, that is, as though it were governed by a tendency to move toward a single point of equilibrium (where supply meets demand) — a point of optimal efficiency, from the viewpoint of society as a whole (full employment equilibrium). In order to obtain this well-behaved dynamics from their models, though, economists must rely on two unwieldy assumptions: first, that there exists perfect competition among *all* economic agents (that is, no monopolies or oligopolies manipulating prices); and second, that these agents have perfect information about market conditions as well as an unbounded rationality to act on that information, so that each is able to negotiate the deals that maximize the agent's benefit (utility).[64] But when these unrealistic assumptions are relaxed, the dynamics of the market begin to resemble in many respects those of self-organizing structures in liquids, from the controlled flow of a convective cell to the wild patterns of turbulence or even solitons. If, alternatively, the relatively long-lasting and stable structures of some markets are understood as suggesting that a "solid" metaphor were appropriate, market behavior would resemble, among all solids, that of glass — which is guided by multiple equilibria — more than that of a crystal with a single equilibrium. The more amorphous structure of glass results precisely from the conflicting constraints imposed by many attractors (local energy minima) and from the possibility of being "trapped" by an attractor that prevents the optimal use of energy. Markets function like glass in that, in the presence of imperfect conditions (imperfect decision making), they can be trapped in suboptimal equilibria — like a supply–demand equilibrium with high unemployment — as has been well known since Keynes's work in the 1930s.[65]



Liquid crystals.

Cloverleaf intersection.

As Joseph Schumpeter showed around the same time, moreover, the equilibrium on which a market settles need not be a stationary state: more likely than not it will be a cycle instead. The upswing of a cycle will bring prosperity, and the downswing a period of recession and high unemployment. This behavior has been accounted for by models that generate these nonlinear dynamics through a periodic attractor: Kondratieff cycles, for example, in which prices and interest rates follow a fifty-two-year long-wave motion — which has been operating for at least two centuries — have been explained as resulting from positive feedback loops forming in specific areas of the economy (specifically, in the capital goods sector, which produces the machinery needed to generate consumer goods). By amplifying small fluctuations in the relevant sector, these positive feedback loops drive the economy away from equilibrium and trigger a Hopf bifurcation, transforming a steady-state equilibrium into a stable oscillatory motion.[66]

Modeling markets as self-organizing structures has nothing to do with the famous "invisible hand" that, according to some economists, guides a market toward optimal levels of efficiency when left to its own devices. On the contrary, the presence of nonlinear effects throughout the economy — from multiplier–accelerator effects in investment and finance to the multiplicity of delays, bottlenecks, surpluses and shortages stemming from the limited rationality of economic agents — means that real markets must be able to cope with life far from equilibrium, and indeed, to create special buffering structures (inventories, retail stores, banks) for this purpose.[67] In short, to the extent that markets emerge and operate spontaneously, they are incapable of achieving optimal equilibria on their own. Other kinds of human organizations, on the other hand — the State, sedentary armies, large corporations — are more capable of goal-directed optimization; these latter can be treated as crystallizations in the flows of matter and energy.

And yet, not even these are perfect crystalline structures, for just as the dynamics permitting actual formation of crystals is complicated by the Earth's real conditions — by gravity, notably — so are the dynamics of human institutions. If one wants to grow "pure" crystals, one must do so (for now) aboard a space shuttle, where the single point of equilibrium guiding their formation is artificially isolated from other influences. Should one attempt to do so on Earth, crystals require special nonequilibrium structures, "dislocations," which trap energy locally to allow a crystal to overcome limitations to its growth. Iberall has compared the role of dislocations to that of human elites in the development of State institutions: these elites operate, for example, by monopolizing a surplus of grain that allows the State to extend its regular structure over the more amorphous agricultural villages around it.[68] And these organizations, precisely because of their hierarchical nature permitting the controlled application of reason and power, are more capable than "pure" markets of reaching more or less optimal solutions to social problems.

If hierarchies have this advantage over markets, though, they present other dangers of their own. Robert Crosby has described these in terms appropriate to this analysis: the goals of the elite often tend to diverge from those of lower hierarchical levels, and when this occurs ever-greater amounts of energy must be diverted to the task of making the lower levels comply with official goals — rules multiply, enforcement units proliferate, punitive means increase.[69] According to Crosby, we may have to search for the right mixture of fluid market structures and more stratified hierarchical organizations: a hybrid system combining the resilience and adaptability of markets with the goal-seeking behavior of hierarchies.[70] Ideally, such a hybrid would be able to avoid the dangers of markets (like the formation of monopolies due to economies of scale, or the disregard of "external" effects and costs, like pollution), as well as the need to exercise that eternal temptation of command structures: too much control.

Is it possible to design stratometers capable of performing the necessary measurements to give this hybrid the right consistency and viscosity? In a sense, yes. For example, among the considerations involved in such a design could be that of creating a new conception of control. Crosby suggests that if we could manage to map the attractors and bifurcations governing the dynamics of a given human community, we could then articulate a new "philosophy of control" in a few policy rules: if a local sector of a hybrid system were trapped in a nonoptimal attractor, then moving this sector toward a more efficient attractor might be prohibitively costly, so the best policy would be to exercise no control at all; if, on the other hand, this sector were near a bifurcation (or near the border of a basin of attraction), then the proper role of control would be to guide it toward the most favorable outcome (the most favorable available attractor).[71] Such a philosophy, of course, would imply accepting modest gains and accepting suboptimality as a fact of life; but in return, it could allow society to track the machinic phylum, to follow the more natural paths of development, those allowing for a greater consistency or adequacy in our relationships with each other and the environment.

There are, in fact, many proposals as to how to utilize knowledge of self-organizing processes for the purpose of formulating policies, or more generally, strategies of life. Ecologist C. S. Holling, for example, distinguishes between the notions of "stability" (defined as being locked into an attractor) and "resiliency" (defined as existing at the border of a basin of attraction). In his view, ecosystems (whether natural or human-made) are not so much stable as resilient. In other words, the ability to maintain a steady or cyclic state is not considered by him to be as important as the ability to switch rapidly between stable states (attractors), thus allowing more responsiveness to environmental changes. He claims that if mechanisms existed for maintaining a position at the border of several attractors, that is, for achieving resiliency, very little effort would be needed to choose between alternative stable states. If Holling's hypothesis is correct, it means that government policies that attempt to drive, say, the economy toward stability may be approaching the problem in the wrong way and that economic policies should be designed to achieve resiliency instead.[72]

Great Wall of China.

A similar but more radical approach is suggested by the work of scientists like Stuart Kauffman and Christopher Langton. These authors recommend that systems should be located not at the border of a basin of attraction, but rather in the vicinity of certain bifurcations. Through careful exploration of the dynamics of a wide variety of systems, they have found a "magic region" of phase space where self-organizing effects are maximized, that is, where spontaneous self-organization reaches a peak in complexity. This region is reached, they say, by avoiding attractors. In their view, point and limit-cycle attractors are too rigid and predictable to generate anything novel, while chaotic attractors are too wild to produce anything viable. At the frontier between the two (at a bifurcation from periodic to chaotic, for instance), magic happens, and so Kauffman and Langton claim that natural evolution may have in fact selected for mechanisms designed to keep organisms "poised at the edge of chaos."[73]

Another way of thinking about such "poised systems" is in terms of phase transitions in matter. The solid state would represent the existence of too much order, and the gaseous state that of too much chaos. It is well known that the liquid state has more interesting dynamics than the other two states since it can, for example, give rise to vortices and solitons (and other coherent structures). The state at the edge of chaos exists in the vicinity of the solid–liquid bifurcation. It is a state that is not too liquid, but not too solid either, that is, a state with the right viscosity or consistency. Matter in this magic state, according to Langton, acquires spontaneous "computational abilities," almost as if complex computational devices could self-assemble at the frontier with chaos.[74] If this is indeed true, it will have serious consequences for economic policy. In market economies, prices serve as transmitters of information (and incentive), and for this reason economic systems can be seen as complex computers, the sum of the decision-making abilities of many micro-economic agents (consumers and producers). Mainstream economics regards these agents as perfectly rational, so the computational abilities of the economy as a whole are seen simply as a reflection of this underlying rationality. But if nonlinear economics is right, if agents are essentially limited in their rationality as well as in their access to information, then the economy as a whole may have to acquire its power of computation *dynamically*, that is, by operating poised at the edge of chaos.

Because the problems raised by hybrid systems involve both dealing with flows of matter and energy and studying the stratifications that form in those flows, we might do well to learn from the experiences of those who were the first to track the machinic phylum — artisans and metallurgists. Before the advent of modern methods, they did this by using their instincts and the empirical know-how accumulated through the ages. They had to track everything from stratified ore deposits to a metal's melting and crystallization points, and then to experiment with different ways of crossing those bifurcations through forging techniques; they had to look for their own hybrids, that is, synergistic combinations of metals in which the whole spontaneously becomes more than the sum of its parts (alloys), and to allow the materials to have their own say in the final form produced. All of this involved following a given material's local accidents and imperfections, rather than imposing a rigid, preplanned form on it.

According to metallurgist Cyril Stanley Smith, this know-how had been developed well before the Greeks began to apply formal reasoning to these problems, and it was therefore mostly of a sensual nature.[75] These artisans, in a sense, developed a special ability to follow the phylum, to track the machinic effects created by nonlinear phenomena in nature, and it is this ability that we must acquire again if we are to help social hybrid structures evolve. (As *sensual* knowledge, this know-how would constitute yet another stratometer, one built into our own bodies.)

Artisans and metallurgists, though, are not the only source of insight for such a project: the Earth itself has been dealing with flows of matter and energy for millennia, and herein lies the wisdom of the rocks from which we might derive our inspiration. In geological, hydrological and organic strata (as well as in the two other strata that bind us, intentionality and language[76]), we can always find some elementary components that are not only less stratified, less bound to their attractor, but that are also capable of destratifying their own and other systems' components by pushing them away from their attractors, toward the border of their basin of attraction, where small fluctuations can then tip the system into a completely new regime. In the lithosphere, for example, this role is played by metallic catalysts: by interacting with various other elements and thereby allowing them to transform each other chemically, they enable inert matter to explore the space of possible chemical combinations, in a nonconscious search for new machinelike solutions to problems of matter and energy flow. It is as though catalysts were, to use Deleuze and Guattari's term, the Earth's own "probe heads," its own built-in device for exploration; and indeed, to the extent that autocatalytic loops and hypercycles were part of the machinery involved in the "discovery" of life, these probe heads allowed physicochemical strata to transform themselves and their milieus into completely new worlds.

Polyhedral salt crystals.

We ourselves must become this kind of probe head in our own strata, and allow society to explore and experiment with the possible machinic solutions to its own problems. We must create stratometers of every kind — mathematical *and* nonmathematical — and get to work mapping the attractors that define our local destinies and the bifurcations that could allow us to modify these destinies. And though this is undoubtedly an enterprise fraught with dangers, we can derive some comfort from the hints of the machinic phylum that have recently become visible to us and seem to indicate there may be ways of evading our currently doomed environmental destiny.

NOTES

1. Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1970), p. 116.

2. Ian Stewart, *Does God Play Dice? The Mathematics of Chaos* (Oxford: Basil Blackwell, 1989), p. 186.

3. Hans Degn, Lars Olsen and John Perram, "Bistability, Oscillation and Chaos in an Enzyme Reaction," in Okan Gurel and Otto Rossler, eds., *Bifurcation Theory and Applications in Scientific Disciplines* (New York: New York Academy of Sciences, 1979), p. 623.

4. Ilya Prigogine and Isabelle Stengers, *Order out of Chaos* (New York: Bantam, 1984), p. 14.

5. See, for example, Philip W. Anderson and Daniel L. Stein, "Broken Symmetry, Emergent Properties, Dissipative Structures, Life: Are They Related?" in Eugene Yates, ed., *Self-Organizing Systems* (New York: Plenum, 1987), p. 454.

6. Peter Decker, "Spatial, Chiral and Temporal Self-Organization through Bifurcation in 'Bioids': Open Systems Capable of Generalized Darwinian Evolution," in Gurel and Rossler, eds., *Bifurcation Theory*, p. 236.

7. Gregoire Nicolis and Ilya Prigogine, *Exploring Complexity* (New York: Freeman, 1989), p. 187.

8. David Campbell, "Nonlinear Science: From Paradigms to Practicalities," in Necia Grant Cooper, ed., *From Cardinals to Chaos* (Cambridge, Eng.: Cambridge University Press, 1989), p. 225.

9. John Briggs and F. David Peat, *Turbulent Mirror* (New York: Harper and Row, 1989), p. 121.

10. Ibid., p. 123.

11. Prigogine and Stengers, *Order out of Chaos*, p. 155.

12. Ary L. Goldberger, David R. Rigney and Bruce J. West, "Chaos and Fractals in Human Physiology," *Scientific American* 262.2 (Feb. 1990), p. 42.

13. Alwyn C. Scott, "Solitons in Biological Molecules," in David Pines, ed., *Emerging Syntheses in Science*, Santa Fe Institute Studies in the Sciences of Complexity (Reading, Mass.: Addison-Wesley, 1988).

14. Briggs and Peat, *Turbulent Mirror*, p. 123.

15. Alwyn C. Scott, "Introduction," in Peter Christiansen and R. D. Parmentiert, eds., *Structure, Coherence and Chaos in Dynamical Systems* (Manchester, Eng.: Manchester University Press, 1989), p. 2.

16. David Campbell, "Introduction to Nonlinear Dynamics," in Daniel Stein, ed., *Lectures in the Sciences of Complexity*, Santa Fe Institute Studies in the Sciences of Complexity (Reading, Mass.: Addison-Wesley, 1989), p. 90.

17. Stewart, *Does God Play Dice?*, p. 83.

18. Hermann Haken, "Synergetics and Bifurcation Theory," in Gurel and Rossler, eds., *Bifurcation Theory*, p. 365.

19. Scott, "Introduction," in Christiansen and Parmentiert, eds., *Structure, Coherence and Chaos*, p. 1.

20. "We always get back to this definition: the machinic phylum is materiality, natural or artificial, and both simultaneously; it is matter in movement, in flux, in variation, matter as conveyor of singularities and traits of expression" (Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi [Minneapolis: University of Minnesota Press, 1987], p. 409). Here, the term "singularities" refers to phase transitions and other bifurcations; "traits of expression" are the "emergent properties" that arise in material systems when their global behavior is guided by attractors; and "emergent properties" are those synergistic properties that distinguish a whole as being more than the sum of its parts (properties that cannot be deduced from the components' properties, but only from their interactions).

21. Many may well have "seen" nonorganic life long before the advent of computers: Deleuze, for example, credits several philosophers (from the ancient Stoics to Spinoza, Nietzsche and Bergson) with having "tracked" the machinic phylum in various ways.

Ralph Abraham divides the historical study of bifurcations into three periods, according to the instrument of study used: "The period of direct observation may be much older than we think, but let us say that it begins with the musician Chladni, contemporary of Beethoven, who observed bifurcations of thin plate vibrations.... Analogous phenomena discovered in fluids by Faraday are still actively studied. *These experiments, so valuable because the medium is real, suffer from inflexibility* — especially in choosing initial conditions.... The next wave of bifurcation experiments, which I shall call the analog period, begins with the triode oscillator. The pioneering work of van der Pol (in the 1920's)...produced a flexible analog computer, and institutionalized the subharmonic bifurcations.... The development of the early computing machines ushered in the digital period. Well-known numerical methods were implemented from the start, and graphical output began to appear in the literature. The pioneering papers of Lorenz, and Stein and Ulam, are still studied" ("Dynasim: Exploratory Research in Bifurcations Using Interactive Computer Graphics," in Gurel and Rossler, eds., *Bifurcation Theory*, p. 676).

22. Useful introductions to phase space can be found in: Stewart, *Does God Play Dice?*, ch. 5; James Gleick, *Chaos: Making a New Science* (New York: Viking, 1987), pp. 49–52; and Ralph Abraham and Christopher Shaw, *Dynamics: The Geometry of Behavior*, The Visual Mathematics Library (Santa Cruz, Cal.: Aerial Press, 1985), vol. 1.

23. Prigogine and Stengers, *Order out of Chaos*, p. 206.

24. See Campbell, "Introduction to Nonlinear Dynamics," in Stein, ed., *Lectures in the Sciences of Complexity*, p. 26.

25. A more detailed account of phase transitions from plasma to crystal can be found in Hans Gutbrod and Horst Stocker, "The Nuclear Equation of the State," *Scientific American* 265.5 (Nov. 1991), p. 61.

26. Although the transition from plasma to gas is not in fact "sharp" in the same way that those from gas to liquid or from liquid to solid are, this does not substantially affect this example.

27. According to quantum physics, the virtual orbits around naked nuclei are not attractors but minima of free energy — that is, the equations of quantum physics are linear, and hence do not give rise to self-organization as nonlinear equations do. Many of the pioneers of quantum physics, though — Enrico Fermi, Werner Heisenberg, Louis de Broglie, John von Neumann — envisioned a future in which their discipline would become nonlinear. Various methods have since been proposed that would permit elementary particles to be described in terms of attractors. In *Toward a General Science of Viable Systems* (New York: McGraw Hill, 1972), p. 33, Arthur Iberall offers a nonlinear theory of matter and energy (ranging from atoms to human societies) relying exclusively on limit cycle attractors (which tends to make it mechanistic at points). Iberall challenges received quantum theory, arguing that it provides only a "statistical algorithm" that undoubtedly gives the right results but no conceptual structure with which to understand them (an ad hoc "numerology"); he proposes that it be replaced with a theory that characterizes the eigenvalues (fundamental parameters) of a field in terms of nonlinear limit cycles.

28. Richard Palmer, "Broken Ergodicity," in Stein, ed., *Lectures in the Sciences of Complexity*, p. 275.

29. "The clothes you wear, be they wool, cotton, or silk, are animal or plant gels. They are dyed with colors, which in many instances...are colloid in type.... The leather in your shoes is an animal gel, closely related to the prototype of the *colloids, gelatin.... The wood of the chairs in which you rest is made of cellulose*, which in all its various forms is colloid in nature.... [They] are held together by glue or by steel nails and steel is a colloid solid solution.... The paper upon which you write...[and] the ink in your fountain pens [are] probably also colloid.... [C]olloid, too, is the hard rubber of your pen holders, prepared from that notoriously colloid mother substance, soft rubber" (Wolfgang Ostwald quoted in Milton

Gottlieb, Max Garbuni and Werner Emmerich, *Seven States of Matter* [New York: Walker, 1966], p. 92).

30. Harvey Blatt, Gerard Middleton and Raymond Murray, *The Origin of Sedimentary Rock* (Englewood Cliffs, N.J.: Prentice Hall, 1972), p. 20.

31. Ibid., p. 300.

32. Michael Bisacre, Richard Carlisle, Deborah Robertson and John Ruck, eds., *The Illustrated Encyclopedia of Natural Resources* (New York: Simon and Schuster, 1984), p. 77.

33. Deleuze and Guattari, *A Thousand Plateaus*, p. 40. Hardening, whether soft or rigid, is in no way limited to the form of the example here: for example, soft structures may result from forms of statistical accumulation quite different from sedimentary sorting. These two modes of stratification may also occur simultaneously rather than sequentially.

34. Bisacre et al., eds., *The Illustrated Encyclopedia of Natural Resources*, p. 79.

35. My essay may be seen as expanding on the philosophical insights of Deleuze and Guattari found in the following quote: "The Earth... is a body without organs. This body without organs is permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities [i.e., bifurcations], by mad or transitory particles [e.g., solitons].... [But] there simultaneously occurs upon the earth a very important, inevitable phenomenon that is beneficial in many respects and unfortunate in many others: stratification. Strata are Layers, Belts. They consist of giving form to matters, of imprisoning intensities or locking singularities into systems of resonance and redundancy, of producing upon the body of the earth molecules large and small and organizing them into molar aggregates.... The strata are judgments of God; stratification in general is the entire system of judgments of God (but the earth, or the body without organs, constantly eludes that judgment, flees and becomes destratified, decoded, deterritorialized)" (*A Thousand Plateaus*, p. 40). Deleuze and Guattari call the ethics we might derive from this process "the geology of morals."

36. Arthur Iberall and Harry Soobak, "A Physics for Complex Systems," in Yates, ed., *Self-Organizing Systems*, p. 509.

37. Deleuze and Guattari, *A Thousand Plateaus*, p. 411.

38. Peter Schuster and Karl Sigmund, "Self-Organization of Macromolecules," in Yates, ed., *Self-Organizing Systems*, p. 75.

39. Howard H. Patee, "Instabilities and Information in Biological Self-Organization," in Yates, ed., *Self-Organizing Systems*, p. 334.

40. Vladimir Glisin, Ana Savic, Radomir Crykvenjakov, Sabera Ruzdijic and Neveenka Bajkovic-Moskov, "Molecular Biology in Embryology: The Sea-Urchin Embryo," in Yates, ed., *Self-Organizing Systems*, p. 163.

41. Rupert Sheldrake, *A New Science of Life: The Hypothesis of Formative Causation* (Los Angeles: J. P. Tarcher, 1981), p. 19.

42. V. French, "Pattern Formation in Animal Development," in C. F. Graham and P. F. Wareing, eds., *Developmental Control in Animals and Plants* (Oxford: Basil Blackwell, 1984), p. 242.

43. Hans Meinhardt, "The Random Character of Bifurcations and the Reproducible Processes in Embryonic Development," in Gurel and Rossler, eds., *Bifurcation Theory*, p. 188.

44. C. H. Waddington, *New Patterns in Genetic Development* (New York: Columbia University Press, 1964), pp. 44–45.

45. Sheldrake, *A New Science of Life*, p. 71.

46. Stuart A. Kauffman, "Principles of Adaptation in Complex Systems," in Stein, ed., *Lectures in the Sciences of Complexity*, pp. 621, 651.

47. P. T. Sounders, *An Introduction to Catastrophe Theory* (New York: Cambridge University Press, 1986), pp. 118–19.

48. Brian C. Goodwin, "The Evolution of Generic Form," in J. Maynard Smith and G. Vida, eds., *Organizational Constraints on the Dynamics of Evolution* (Manchester, Eng.: Manchester University Press, 1990), pp. 114–15.

49. I. G. Simmons, *Biogeography: Natural and Cultural* (London: Edmund Arnold, 1979), pp. 58–62. Further, "The flows of energy and mineral nutrients through an ecosystem manifest themselves as actual animals and plants of a particular species" (p. 79).

50. Many aspects of the reproductive budget (including parental investment and battles of the sexes and the generations) are treated in Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1989), chs. 7, 8, 9.

51. A good discussion of catalytic loops in evolutionary arms races and male decorations can be found in Richard Dawkins, *The Blind Watchmaker* (New York: W. W. Norton, 1987), chs. 7, 8.

52. John Maynard Smith, "Evolution and the Theory of Games," in *Did Darwin Get It Right? Essays on Games, Sex and Evolution* (New York: Chapman Hall, 1989), pp. 206–207.

Evolutionary stable strategies, according to Maynard Smith, are those that are optimal for a given context and cannot therefore be invaded by a mutant strategy. To this extent, they are not stabilized nonlinearly by attractors, but rather linearly, like a crystal. The idea that evolution optimizes is becoming more and more frequently the target of nonlinear science. The arguments are similar to those I use below for the case of human economics (basically, the existence of mutually incompatible constraints). For a criticism and a version of these concepts in terms of attractors, see Kauffman, "Principles of Adaptation," pp. 687–95.

53. Niles Eldrige, *Macro-Evolutionary Dynamics: Species, Niches and Adaptive Peaks* (New York: McGraw Hill, 1989), p. 151.

54. Leon Glass and Michael C. Mackey, *From Clocks to Chaos* (Princeton: Princeton University Press, 1990), pp. 114–15.

55. Ibid., ch. 9.

56. Alan Garfinkel, "The Slime Mold Dictyostelium as a Model of Self-Organizing Systems," in Yates, ed., *Self-Organizing Systems*, p. 200.

57. See Deleuze and Guattari, *A Thousand Plateaus*, ch. 6: "How Do You Make Yourself a Body without Organs?"

58. Gleick, *Chaos*, pp. 59–77; R. M. May, "Chaos and Dynamics of Biological

Populations," in *Dynamical Chaos* (London: Royal Society, 1987); and Manfred Peshel and Werner Mende, *The Predator–Prey Model: Do We Live in a Volterra World?* (Vienna: Springer, 1986).

59. Arthur Iberall, "A Physics for the Study of Civilizations," in Yates, ed., *Self-Organizing Systems*, pp. 531–33.

60. Ibid., p. 533.

61. See Pierre Clastres, *Society against the State*, trans. Robert Hurley (New York: Zone Books, 1987), p. 189ff. "Societies against the State" have also been termed "anticivilizations" to stress their effective resistance to crystallization into a stratified society: see Gordon W. Hewes, "Agriculture and Civilization," in Matthew Melko and Leighton R. Scott, eds., *The Boundaries of Civilization in Space and Time* (Landham, Md.: University Press of America, 1987), p. 199.

62. See, for example, Gilles Deleuze, "Politics," *Semiotext(e)* 8 (1978), pp. 154–63.

63. Deleuze and Guattari, *A Thousand Plateaus*, ch. 11: "The Refrain."

64. In some mathematical models, periodic and even strange attractors can result if we maintain these two assumptions: in other words, even if the model allows markets to clear perfectly (supply always exactly satisfying demand), and the agents are given perfect foresight, cycles and chaos can result if we include nonlinear financial constraints (for example, limited access to borrowing). See Michael Woodford, "Finance, Instability and Cycles," in Willi Semmler, ed., *Financial Dynamics and Business Cycles: New Perspectives* (Armonk, N.Y.: M. E. Sharpe, 1989).

65. On the phenomenon of "locking in" suboptimal equilibria, see W. Brian Arthur, "Self-Reinforcing Mechanisms in Economics," in Philip W. Anderson, Kenneth J. Arrow and David Pines, eds., *The Economy as an Evolving Complex System* (Reading, Mass.: Addison-Wesley, 1988).

66. A recent nonlinear model of Kondratieff cycles can be found in: J. D. Sterman, "Nonlinear Dynamics in the World Economy: The Long Wave," in Christiansen and Parmentiert, eds., *Structure, Coherence and Chaos*. Also of note is the pioneering work of Richard Goodwin, who has been using nonlinear models since the 1950s: see his *Essays in Nonlinear Economic Dynamics* (Frankfurt: Peter Lang, 1989). There are many models of Kondratieff cycles, both linear and nonlinear; for a survey, see Christopher Freeman, ed., *Long Waves in the World Economy* (Stoneham, Mass.: Butterworth, 1983).

67. Richard H. Day, "Adaptive Economics," in Robert Crosby, ed., *Cities and Regions as Non-Linear Decision Systems* (Washington, D.C.: AAAS, 1983), p. 10.

68. On the role of dislocation structures in real crystals, see Allan Bennet, "The Importance of Imperfections," in Sharon Banigan, ed., *Crystals, Perfect and Imperfect* (New York: Walker, 1965), p. 85. On human elites as dislocations, see Iberall, *Toward a General Science*, p. 208.

69. Robert Crosby, "Asking Better Questions," in Crosby, ed., *Cities and Regions*, p. 10.

70. Ibid., p. 12.

71. Ibid., p. 21.

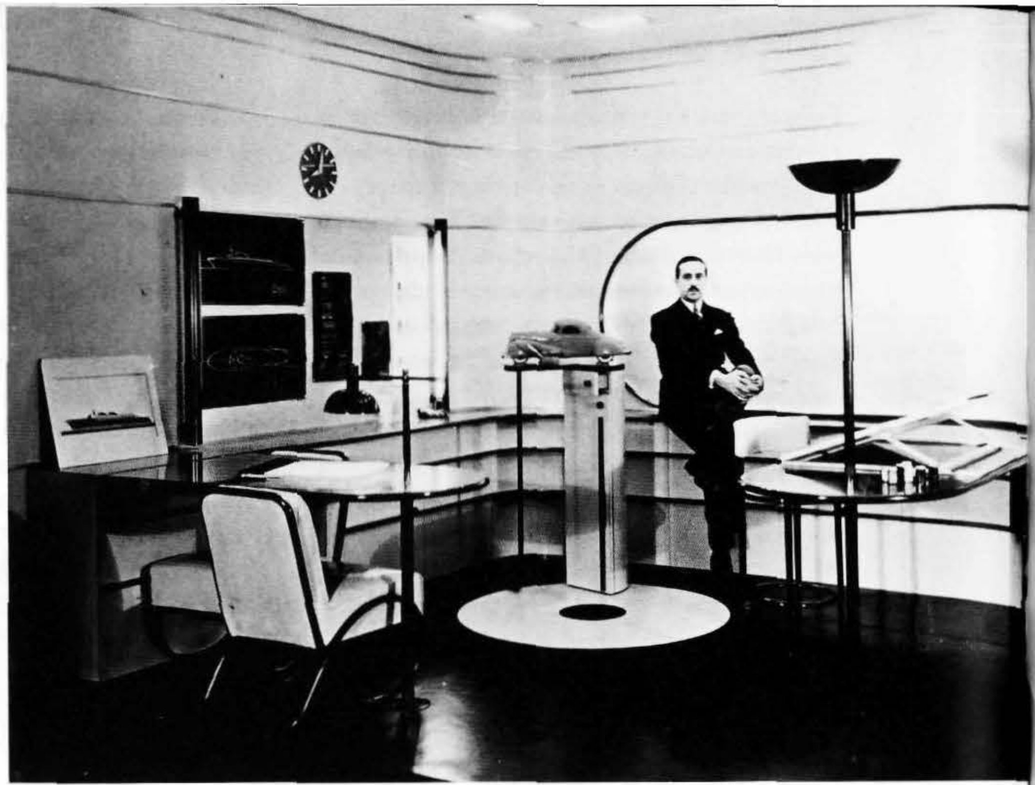
72. C. S. Holling, "Resilience and Stability in Ecosystems," in Erich Jantsch and Conrad H. Waddington, eds., *Evolution and Consciousness* (Reading, Mass.: Addison-Wesley, 1976), p. 87.

73. Stuart A. Kauffman, "Antichaos and Adaptation," *Scientific American* 265.2 (Aug. 1991), p. 82; and Christopher Langton, "Life at the Edge of Chaos," in Langton, Charles Taylor, J. Doyne Farmer and Steen Rasmussen, eds., *Artificial Life* (Reading, Mass.: Addison-Wesley, 1992), p. 85.

74. Langton, "Life at the Edge," p. 82. If as Langton and Kauffman think, poised systems are where complexity and variety peak (i.e., are "crossed" in the most intense form by the machinic phylum), then we may imagine a different set of policies (or even philosophies of everyday life). We would have to track these special zones, for example, by destratifying ourselves (that is, by pushing our "solid" components a little, but only a little, toward the "liquid" state). Just exactly how much to "liquify" should be established through careful experimentation, since there are dangers if one goes too far (one may be swallowed up by a chaotic attractor). This is how Deleuze and Guattari put it: "You don't reach the [machinic phylum] by wildly destratifying.... If you free it with too violent an action, if you blow apart the strata without taking precautions, then instead of [tapping into the phylum] you will be killed, plunged into a black hole, or even dragged toward catastrophe. Staying stratified — organized, signified, subjected — is not the worst that can happen; the worst that can happen is if you throw the strata into demented or suicidal collapse, which brings them back down on us heavier than ever. This is how it should be done: Lodge yourself on a stratum, experiment with opportunities it offers, find an advantageous place on it, find potential movements of deterritorialization, possible lines of flight, experience them, produce flow conjunctions here and there, try out continuums of intensities segment by segment, have a small plot of new land at all times" (*A Thousand Plateaus*, pp. 160–61).

75. Cyril Stanley Smith, *A Search for Structure* (Cambridge, Mass.: MIT Press, 1982), p. 113.

76. Intentional strata correspond to the world of beliefs and desires as they exist in the animal kingdom, past a certain level of complexity of informational flow. The sedimentations and hardenings that make up these strata grow "on top" of the organic stratum (they use the brain as their substratum). They, in turn, provide the raw materials for the emergence in humans of linguistic strata. Deleuze and Guattari offer theories on these two strata, which they call "subjectification" and "signifiance." I shall produce a more detailed exposition of these topics in my forthcoming book *Chaos and the Millennium*.



The Metropolitan Museum of Art invited several industrial designers to assist the architects participating in the 1934 contemporary Industrial Art Exhibition. Lee Simonson worked with Raymond Loewy (shown here) to create this mockup of an ideal industrial designer's office. Note the three-line motif.

Hygiene, Cuisine and the Product World of Early Twentieth-Century America

Ellen Lupton and J. Abbott Miller

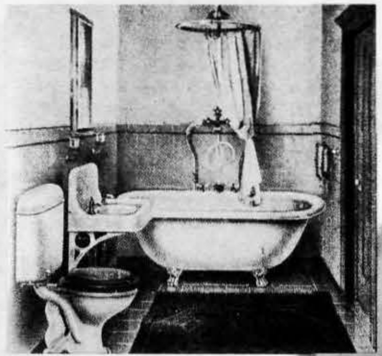
Viewed through the categories of traditional art history, "modernism" is a visual style characterized by geometry, simplification, the rejection of conventional types and the invention of new sculptural or graphic forms. "Modernism" also manifested itself in relation to the massive changes that swept through the fields of hygiene and cuisine in the early twentieth century. Modern design has two faces: its public front equates "modernism" with a reduced, elemental style that embraces the imagery and rationality of the Machine Age, while a more private, hidden side may be linked to a reorganization of the human digestive system, enabled by the creation of new products, environments and civic structures.

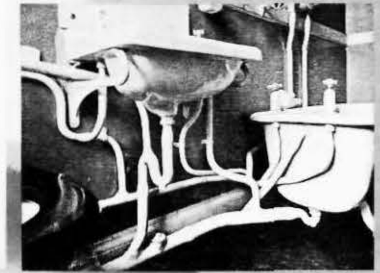
An art historian might compare a piece of furniture with abstraction and the aesthetics of the machine in art and architecture. Take, for example, Raymond Loewy's model interior for an industrial designer's office, erected in the Metropolitan Museum of Art in 1934.[1] A standard stylistic analysis of Loewy's ideal office might note the reduction of decorative elements to a simple vocabulary of circular and rectilinear forms. The curving structure of the chairs and tables is articulated by a black metal outline, echoing the graphic bands applied to the wall surface. Geometric light fixtures pierce the tabletops, suggesting roots anchored to the floor and stems growing upward to the ceiling. The room allusively suggests an elegant ocean liner, a scientific laboratory or a futuristic spacecraft.

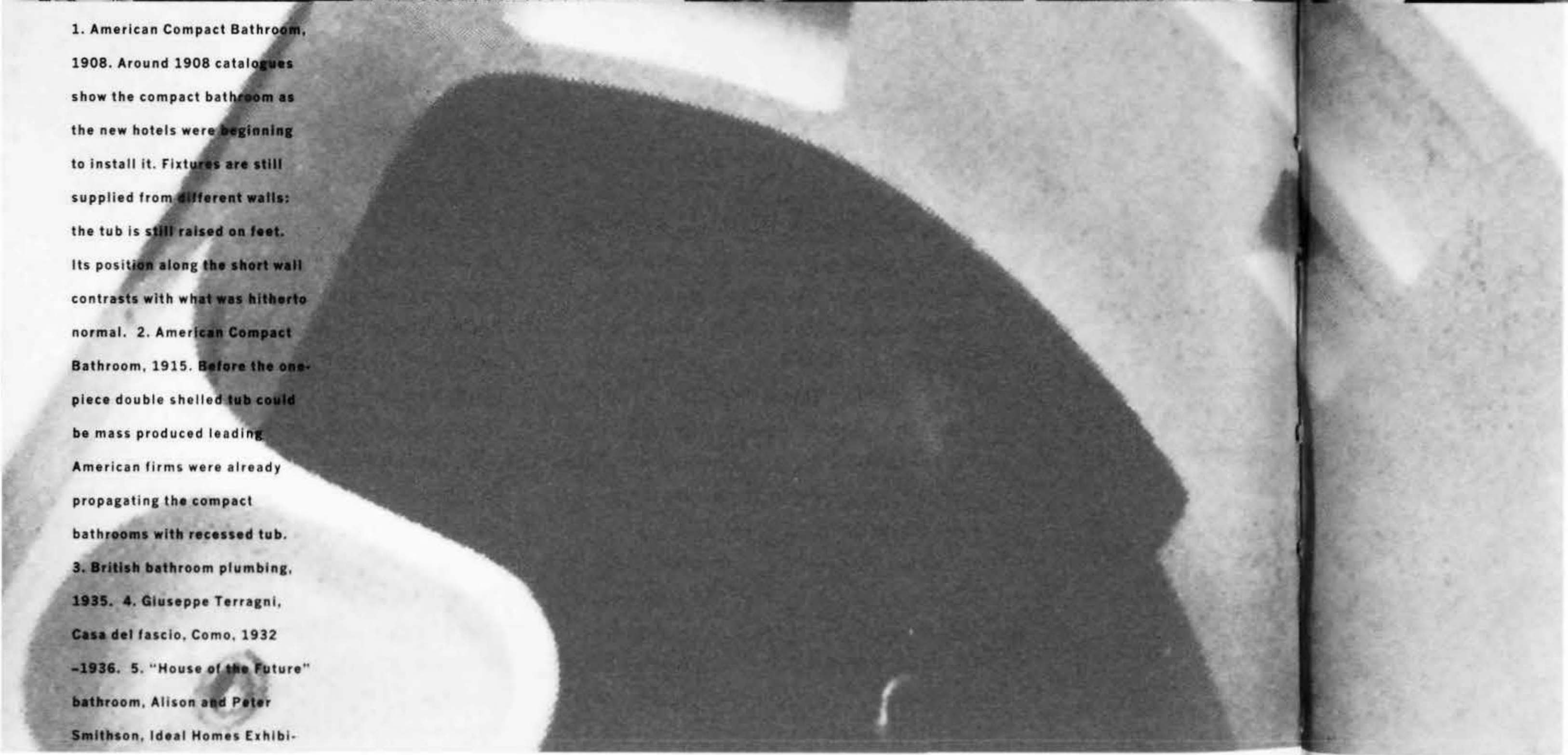
Loewy's ideal workshop, however, has sources in a "modernism" of a more domestic sort: not the ocean liner's glamour or the laboratory's rigor but the mundane, familiar and feminized space of the bathroom and kitchen. Loewy has replaced the carved paneling, heavy drapery and rich carpets of the traditional executive suite with built-in cabinets, stationary fixtures, nonporous surfaces and curved forms — typical features of the modern bathroom and kitchen. Hard, seamless linoleum has replaced dust-collecting wood and carpets, concealed storage has replaced open shelving and stationary fixtures have replaced freestanding tables and movable cabinets. Like plumbing pipes, the lamp stems penetrate the floor and counters, apparently integrated into the structure of the building itself. The rounded corners of walls, tables and storage units suggest an easy-to-clean surface harboring no dust or germs.

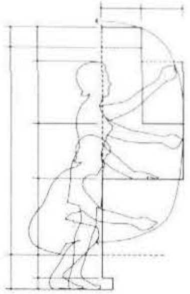
Modernizing the Bathroom and Kitchen

The modern American bathroom is an invention of the late nineteenth century, arising from the establishment of new urban systems for water supply and waste disposal.[2] Although water supplies were instituted as early as the 1790s









1. American Compact Bathroom, 1908. Around 1908 catalogues show the compact bathroom as the new hotels were beginning to install it. Fixtures are still supplied from different walls: the tub is still raised on feet. Its position along the short wall contrasts with what was hitherto normal. 2. American Compact Bathroom, 1915. Before the one-piece double shelled tub could be mass produced leading American firms were already propagating the compact bathrooms with recessed tub. 3. British bathroom plumbing, 1935. 4. Giuseppe Terragni, Casa del fascio, Como, 1932–1936. 5. "House of the Future" bathroom, Alison and Peter Smithson, Ideal Homes Exhibition, 1956. 6 & 7. Biosphere 2 bathroom, Oracle, Arizona.

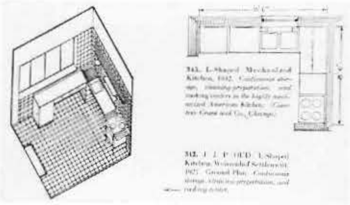
and developed unevenly from then on, the physical and bureaucratic integration of such resources did not begin until the late nineteenth century. Water *supply* technology advanced ahead of water and waste *drainage*, though, resulting in new sanitation and health problems. The actions of health reformers led American cities to frame health codes and plumbing standards in the 1880s.[3] Indoor plumbing, toilets and bathtubs did not become part of an "American standard" of middle-class living until the 1920s.[4]

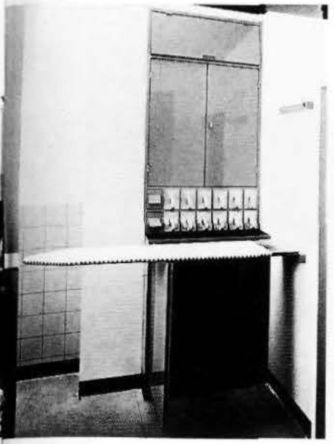
Prior to the advent of modern plumbing, sanitary devices were used in various areas of the house. Bathing took place in small tubs, easily moved and emptied, which might be found in the bedroom or kitchen, near the hearth for warming water; bowls for more casual bathing rested on washstands. Outhouses were constructed away from the home, and chamber pots were kept most often in small cupboards near the bedside, or disguised with amusing trompe l'oeil techniques.[5]

With the spread of indoor plumbing, the washbasin and the toilet with flushed water drainage assumed a *fixed* position in relation to the plumbing. Accordingly, the "bathroom" became a fixed location in the home, tied to the structure of the building by pipes for water and waste: the pot chamber replaced the chamber pot. When bathrooms with running water were incorporated into existing homes, they were either assigned marginal spaces such as stairwell landings or, at the other extreme, were allowed to take over bedrooms. In middle- and upper-class Victorian homes, early plumbing devices mingled with the furniture, decorative schemes and rich drapes and carpets of bedrooms and parlors: the bathroom was a kind of hybrid space containing the latest in technology and sensual comforts.

It was at the turn of the century that the bathroom was more strictly defined as a site of sanitary care. As promotional images show, aesthetically and technically coordinated fixtures replaced the loose accumulation of chamber pots, portable tubs, washstands and "running water appliances." White porcelain and bright, polished metals were favored because they revealed the presence of dirt: they were proof of their own cleanliness. The bathroom became a test for the hygiene of the entire house and of the family living there; as a 1917 essay in an architectural journal remarked, "The bathroom is an index to civilization. Time was when it sufficed for a man to be civilized in his mind. We now require a civilization of the body."[6]

The differences between a bedroom or stairwell landing populated with "hygienic furniture" and the bathroom designed as a fully industrialized ensemble of porcelain-enameled fixtures reflect a larger development in health and hygiene: the gradual acceptance of the germ theory of disease, which was the basis for much nineteenth-century health reform. Germ theory, proven in the 1880s with the identification of the disease-producing bacteria of typhus, tuberculosis and cholera, postulated that disease could be transmitted by germs living in dust, dirty clothing, unwashed hands, houseflies, ice — virtually any unclean substance. The entire domestic terrain was animated by potential disease. Germ theory made the thick carpeting, drapery and even





1. J. J. P. Oud, Weissenhof Settlement, Stuttgart, 1927. 2. J. J. P. Oud, L-Shaped Kitchen, Weissenhof Settlement, 1927. Ground Plan. Continuous storage, cleaning-preparation and cooking center. 3. Grete Schütte-Lihotzsky, Variant of the Frankfurt Kitchen, Leipzig, 1930. 4. Demonstration Kitchen of Brooklyn Borough Gas Co., based on motion study, 1930 5. Reconstruction of the Frankfurt Kitchen by Haags Gemeentemuseum, 1982. 6. Kitchen, Eileen Gray.

the wallpaper of Victorian bathrooms incompatible with "modern" hygienic standards.[7]

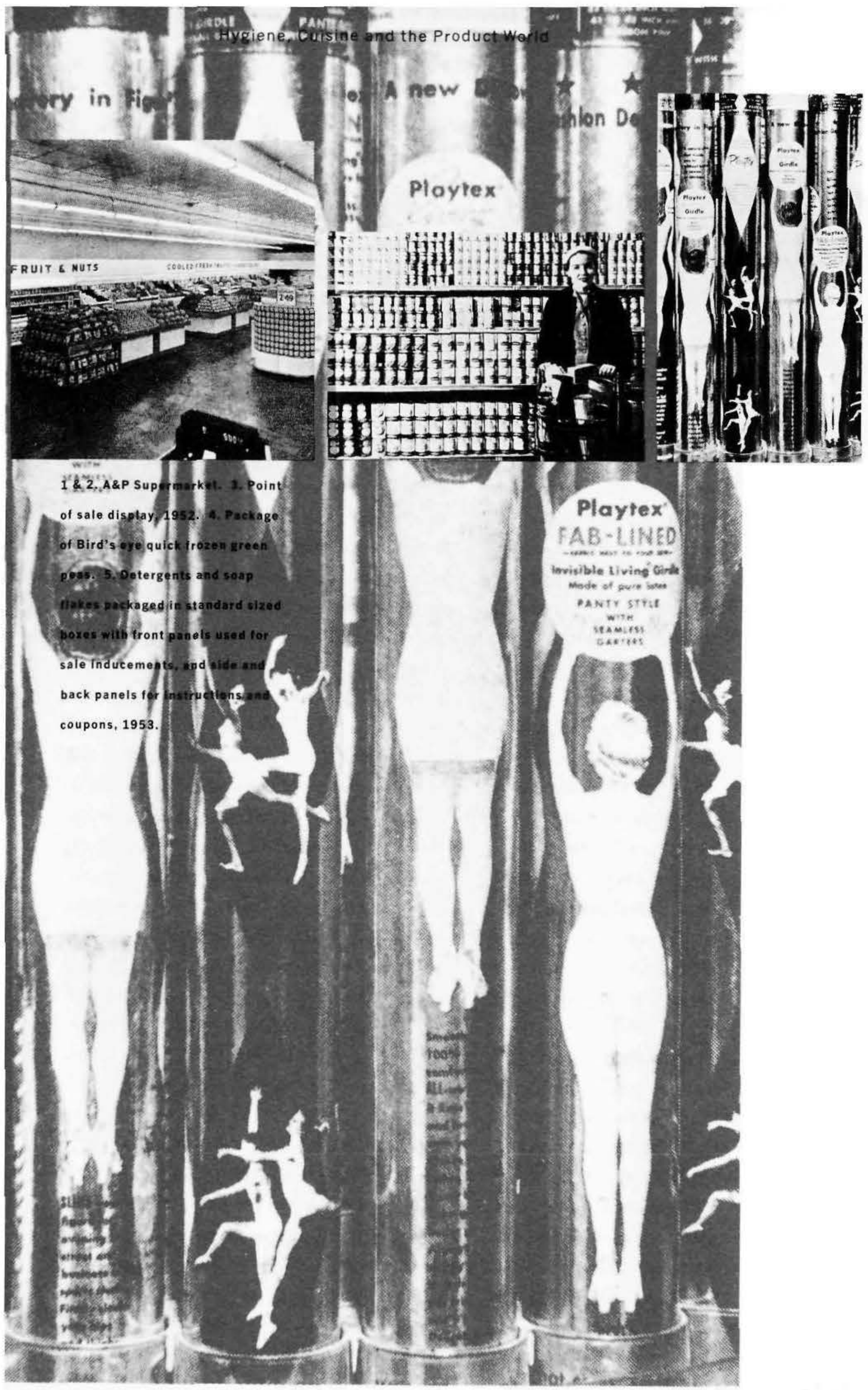
Following the bathroom, the middle-class kitchen also underwent technological and aesthetic changes in the early twentieth century. The adoption of nonporous materials for flooring, shelving and work surfaces in the first decades of this century reflected the same ethos of hygiene — as did the gradual disappearance of legs from stoves, refrigerators, sinks and storage units in the 1920s and 1930s. The modern kitchen, like the bathroom, came to favor *fixtures* over *furniture*: the enclosed, cubic forms of modern appliances and cabinets were apparently integrated into the structure of the room, and they eliminated the dust-collecting space beneath them.[8]

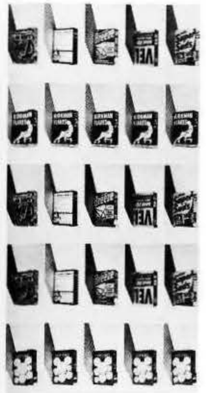
Built-in kitchen cabinets are seen in linoleum ads as early as 1921. In addition to reflecting new standards of household cleanliness, built-in cabinetry embodied contemporary theories of how housework should be organized. The widely circulated book *American Woman's Home*, written by Catharine Beecher and Harriet Beecher Stowe in 1869, features a kitchen design with sink and work surface integrated by a single cabinet base; the surrounding walls are lined with shelves.[9] Their model is the "cook's galley in a steamship [which] has every article and utensil used in cooking for two hundred persons, in a space not larger than this stove room, and so arranged that with one or two steps the cook can reach all he uses."[10] This ideal kitchen, however, was not widely adopted by builders.

The idea of analyzing the kitchen into an efficient work space was promoted again by Christine Frederick, a domestic theorist retained by the *Ladies Home Journal* in the years after 1910. Frederick's 1920 book *Household Engineering* applied the Taylorization of factory labor to housework.[11] As the historian Dolores Hayden has pointed out, the Taylorizing of housework is logically untenable: unlike the factory management on which it was modeled, which presupposes the division of labor into discrete, repetitive motions, the modern housewife works alone on a wide range of tasks.[12] Nevertheless, Frederick's "new housekeeping" attracted considerable publicity — including notice from Taylor himself — and she and other theoretically minded housewives were hired as consultants to the appliance industry.

Frederick focused on the arrangement of kitchen labor rather than the design of individual appliances. Her theories were advanced in the 1920s by German designers and architects, who based on them the redesign of the kitchen's physical units — eventually developing the standard of the built-in, continuous assemblage of cabinets and appliances.[13] No less a personage than architect Bruno Taut took interest in her irrational and rationalized kitchen plans.[14]

The stove designed by Norman Bel Geddes for the Standard Gas Equipment Company in 1932 helped establish the ideal of the modern appliance as an enclosed box sitting on a low base. Geddes's design quickly became the paradigmatic modern stove: an interior framework to which metal panels are clipped. (Such a modular system allowed the manufacturer to assemble a variety of models from one kit of parts.) The stove occupies a single level, with an oven underneath; next to the oven is a concealed compartment for storing pots and pans.





1 & 2. A&P Supermarket. 3. Point of sale display, 1952. 4. Package of Bird's eye quick frozen green peas. 5. Detergents and soap flakes packaged in standard sized boxes with front panels used for sale inducements, and side and back panels for instructions and coupons, 1953.

A metal lid covers the stove when not in use, protecting it from dust and unifying it with the other work surfaces of the kitchen. Geddes's stove has been compared to the modern skyscraper, which was also constructed out of modular panels fixed to a steel frame,[15] but there is another source as well — less monumental but more familiar to the kitchen: packaged food.

This type of merchandise, which began to proliferate rapidly in the 1880s, soon dominated urban and suburban grocery sales across the United States. As a primary object of exchange in the rapidly rising consumer economy, packaged food made its mark in industry as well: in 1900, food processing accounted for 20 percent of U.S. manufacturing, and in 1901, food advertising accounted for nearly 15 percent of the business of N. W. Ayer, America's largest advertising agency. Food remained the single most advertised commodity until the 1930s, when it was surpassed by the automobile.[16]

Packaging was a major force in the shift from locally based agriculture to the dominance of corporate food production around the turn of the century. By 1910, many brand names that remain "household words" today were the trademarks of nationally distributed products, including Quaker Oats (1901) and Kellogg's Toasted Cornflakes (1903). Paperboard boxes served to package and advertise dry foods such as crackers and grains, which formerly had been sold in bulk by wholesalers to grocers — conventional products distributed in a new way. This was by no means the rule, though: the first "continuous-process canning" factories — which cooked, preserved and packaged meats and vegetables in a single process — were operated by H. J. Heinz and the Campbell's Soup Company, beginning in the 1880s.[17]

The food package encloses the product in a smooth, uninterrupted skin, giving the organic, shapeless substance inside a clear geometric shape; and it seals the product not only from the elements but from view as well — much as the shells of modern kitchen cabinetry and appliances would later hide the tools and materials of the kitchen. Unlike them, though, modern packaging becomes useless garbage at the end of the consumer cycle: this built-in wastefulness was extended to durable goods in the 1920s and 1930s, when advertising and marketing publicists sought to justify the inherent wastefulness of the modern "consumer economy." Such an economy sells industrial products to a large populace through high-volume production, making individual items cheaper by selling a greater number. The consumer economy was frequently contrasted with traditional European manufacture, in which a smaller quantity of goods, costing more individually, was sold to a smaller and wealthier group. American mass manufacture staked its success on the idea that the working class was a *consuming* class: the capital invested in mass-production ventures required that vast quantities of products be sold to the largest market of all, the wage-earning population.[18]

Because such a consumer economy would fail when the market reached a saturation point, *waste* became an essential component of the *production* cycle. Industry, then, needed to shorten the natural "lifespan" of "durable" products, so that people would buy them not once but several times, thereby stabilizing the production cycle. The most powerful engine of planned obsolescence was stylistic change, an impetus for replacing objects that were not yet physically worn out. Raymond Loewy's 1930 "Evolution Chart of Design" depicts objects in a Darwinian cycle of perpetual transformation: the final product in the series is the female body, a primary marketing site for the expanding consumer economy.

Although designers and advertisers used the term "consumption" in reference to durables such as radios, furniture and clothing, the term's more literal reference was to the food cycle: *to consume* means to devour, to eat in a voracious, gluttonous manner. To consume an object is to destroy it in the process of implementing it, as fire consumes a forest. The advertising executive Ernest Elmo Calkins wrote in 1922, "Goods fall into two classes, those which we use, such as motor cars and safety razors, and those which we use *up*, such as tooth paste or soda biscuit. Consumer engineering must see to it that we use *up* the kind of goods we now merely use."[19] The continual movement of goods through the consumer economy — figured as a kind of "body," whose health depends on continual production and waste, ingestion and excretion — was thus made analogous to human digestion by the promoters of planned obsolescence. "Waste" was conceived not merely as an incidental by-product of the consumption cycle, nor even as an essential moment in it, *but as a generative force.*

Advertising raised the cost of products but was defended as a necessary lubricant for the continual flow of goods through the system: it created desire for new goods (and generated emotional distinctions between things otherwise indistinguishable). It was a major force, moreover, in spreading the new standards of hygiene, housekeeping and nutrition, by promoting the products that promised to make these ideals attainable and describing them in tones of moral urgency.[20]

Giving voice to the ethos of disposal, Christine Frederick employed the oxymoron "creative waste" to describe the housewife's moral and social obligation to buy and discard products rhythmically. The phrase "creative waste" elevated garbage to a form of positive production, valuing the destruction and replacement of objects as a pleasurable and socially instrumental act.[21] In 1841, Catharine Beecher had already described the consumerist ethos: "The use of superfluities... to a certain extent, is as indispensable to promote industry, virtue, and religion, as any direct giving of money or time."[22] Thus, just as consumption had pervaded the logic of production in the consumer economy, "production" found its place in the process of consumption — a cycle paralleled by the body's most conspicuous and original product, its most "creative" form of waste: excrement.

As the settings for physical sustenance and hygienic care, the kitchen and bathroom — and the product "worlds" they frame — are crucial to intimate bodily experience, helping to form the individual's sense of cleanliness and filth, taste and distaste, pleasure and shame. These rooms are the home's most heavily invested "objects" of domestic labor: failure to meet the high standards of hygienic maintenance attached to them is a source of guilt and embarrassment. Freud wrote that a major domain of infantile sexual experience is the mother's constant attention to the mouth, anus and genitals: feeding, wiping, washing, powdering.[23] By extension and association, the "erogenous zones" of the home are its kitchen and bathroom, which require continual maternal maintenance and are the locale of oral pleasure and personal care for the whole family. The symbolic entrance of the typical suburban home is located at its facade (its "face"), but the home's functioning entrance is more often its back door or "service entry": this aperture — at once mouth and anus — receives and expels a myriad of goods and services. As one architectural writer explained in 1922, "The butcher, the baker, the grocer all deliver their wares at the [service] entry door, and most of the waste must find its way through [this] entry before being removed from the house."[24]

The evolution of industrial methods and economic sectors, domestic spaces and hygienic and culinary concerns were all tied together by across-the-board changes — some as practical as plumbing, others as "subtle" as Frederick's "new housekeeping," the invention of the modern bathroom, and the discovery of ubiquitous germ-infested surfaces. Given these developments, it is not untenable to speak of the home as a "disciplinary" site in the Foucauldian sense.[25] The home as we have described it, in particular through the modern bathroom and the modernized kitchen, determines yet another form of docility: *consumerism*, a physical realization of the logic of the market economy and its cycles of ingestion and waste.

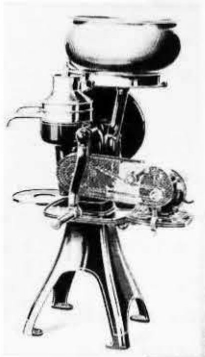
While Foucault's disciplinary institutions (school, hospital, prison, factory) are objects of state, municipal or corporate control, the modern home presents itself as a locale for "private" experience: private property, private leisure and private sexual and familial life. This sense of privacy is epitomized by the sealed-off space of the bathroom, lodged at the core of home: the bathroom door can be locked even against other family members. The ideology of the home as a "private" place was exploited and reinforced by the marketers of domestic appliances in the early twentieth century, who discouraged the formation of centralized laundry and cleaning services by appealing to the sense that such work should be done at home — that is, *house*work — and that every home should have its own mechanical appliances.[26] While many standard histories of industrial design describe the mechanization of the home as the progressive liberation of women from domestic drudgery, feminist historians have argued that the appearance of modern appliances was accompanied by ever-more rigorous standards of cleanliness and maternal duty, and a schedule increasingly committed to consumption activities.[27] The private "inside" of the household is continually penetrated by external goods, services and media.

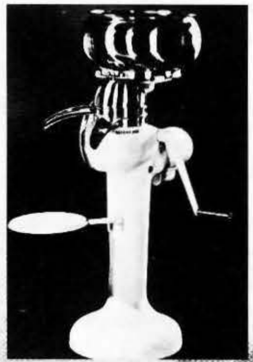
Housework — food preparation, home maintenance, childcare and so on — has traditionally had a peculiar relation to the money economy. Typically, it does not create goods or services sold for cash in the marketplace; rather, it involves *spending* rather than *earning* money. Twentieth-century housework, in particular, has largely consisted of managing consumption and waste: the intake of goods, services and utilities and their expulsion from the home in the form of packaging, sewage, bills and discarded objects.[28] Thus, because it does not constitute "production" as it is typically understood, housework has been marginalized in the discourses of both capitalism and Marxism.[29]

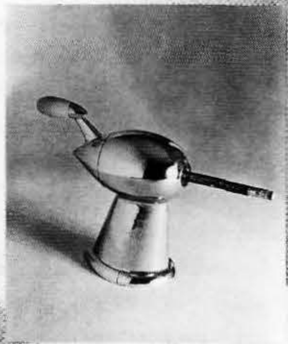
Industrialized food was a primary model for the production and consumption of durable goods. Package design, product design, advertising and market research were all services offered by major advertising agencies in the 1920s and 1930s, such as Ernest Elmo Calkins' firm Calkins and Holden — one indication of the fact that product design was in great part an extension of the advertising business. Many industrial designers did in fact begin their careers with advertising and packaging, and there are numerous product designs that primarily engage the exterior shell of an object but not its working parts. For example, Loewy's redesigns of the Gestetner duplicating machine (1929) and the International Harvester cream separator (1937) both involved the creation of external casings for an aggregate of mechanical parts. Similarly, Loewy's Sears Coldspot refrigerator designs, produced yearly between 1935 and 1938, were merely modifications of the external box.[30] Loewy explained his process:

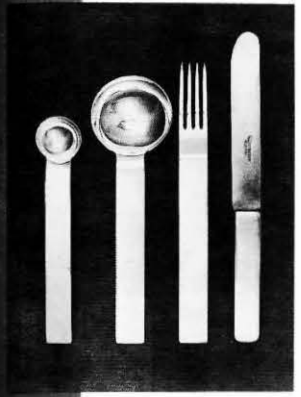
> I believe that when a given product has been reduced to its functional best and still looks disorganized and ugly, a plain, simple shield, easily removable, is aesthetically justified. This shield itself accomplishes something, and it becomes functional, the specific function being to eliminate confusion.[31]

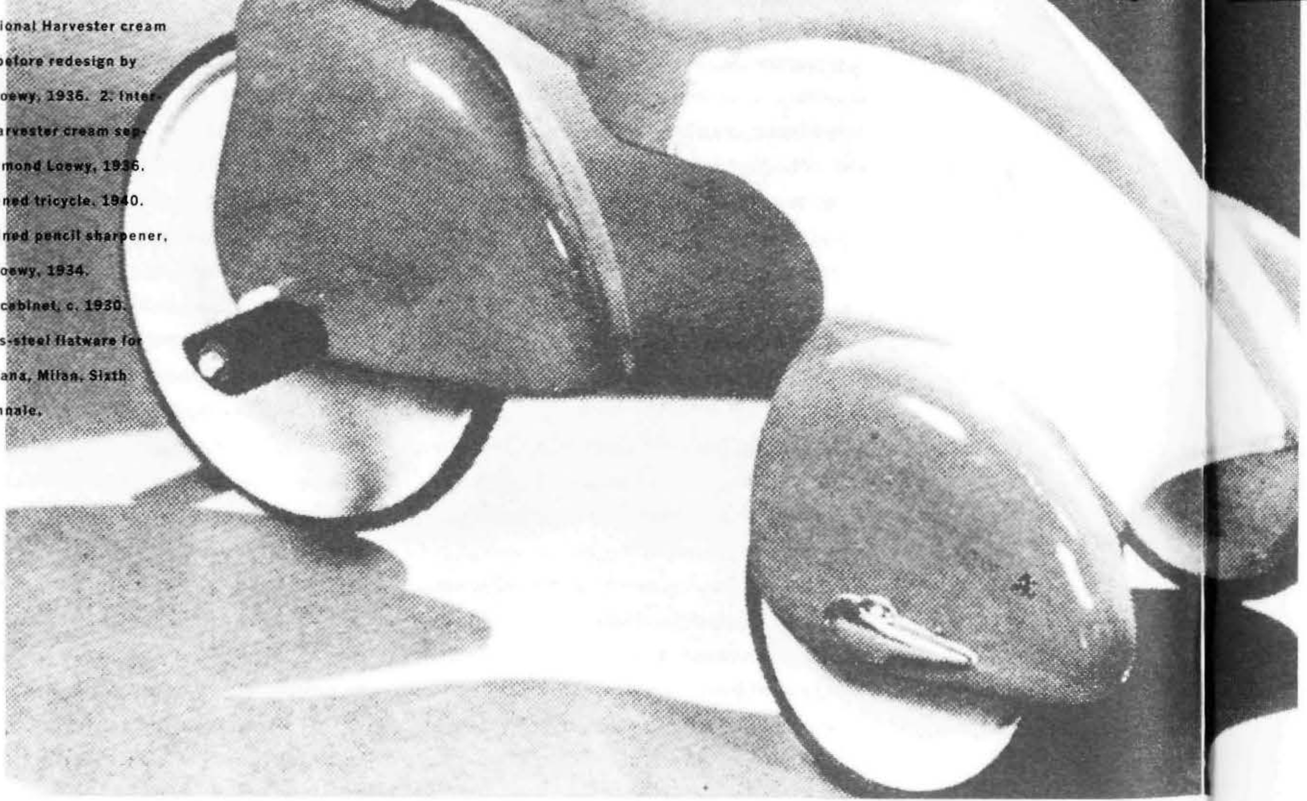
The continual stylistic modification of consumer goods such as refrigerators, toasters and cars of course shortened their life span











1. International Harvester cream separator before redesign by Raymond Loewy, 1936. 2. International Harvester cream separator, Raymond Loewy, 1936. 3. Streamlined tricycle, 1940. 4. Streamlined pencil sharpener, Raymond Loewy, 1934. 5. Kitchen cabinet, c. 1930. 6. Stainless-steel flatware for Krupp Italiana, Milan, Sixth Milan Triennale.

and ensured their eventual replacement by new models.

A central structure of Marx's thought, according to Elaine Scarry, is the reciprocity between object and body: every manufactured object "recreates" the body, and the body itself becomes a kind of manufactured object.[32] In the most primitive subsistence economy, "consumption" amounts to little more than food to fuel the body and provide for tissue regeneration. As economies advance, a "production" emerges that merely supplements more bodily functions with material objects: tools extend the hand, clothing augments the skin and so on. From this perspective, there is no qualitative difference between the most elementary consumable object, food, and the most technically sophisticated prosthetics, for they all relate to the body as a permeable, manipulable surface, ingesting, incorporating and expelling an expanding range of objects. Yet this open-ended circulation does not occur in some pure or open space; rather, as various bodily functions are extended "outside" the body, so the spaces of these extensions are embodied, in every sense of the word.

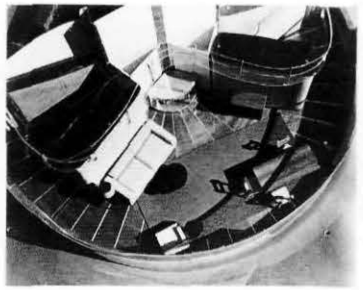
The study of "streamlining" began in the late nineteenth-century research into aerodynamics, and it was originally applied to the design of aircrafts, ships, locomotives and automobiles in a way that reduces the friction encountered in motion ("streamline" referring literally to the path of a particle in a fluid medium as it passes a solid body).[33] The verb "to streamline" (dating from 1913) means, in one sense, to design or construct with a "streamline," in another, to modernize, to organize, to make more efficient or simple — hence the use of "streamlining" to describe the curvaceous, aerodynamic styling typical of 1930s mass-produced objects.

Because such imagery evoked "speed" and "modernity," streamlining evolved into a set of stylistic mannerisms useful for stimulating sales of all kinds of goods, including stationary objects such as Loewy's 1934 pencil sharpener, an object lesson in the misapplication of streamlining.[34] The usefulness of streamlining as a laxative for the consumer economy was eloquently registered by a marketing executive thus: "Streamlining a thing strips it for action, throws off impediments to progress.... [S]treamlining a product and its methods of merchandising is bound to propel it quicker and more profitably through the channels of sales resistance."[35]

That "streamlining" was interchangeable with "cleanlining" points up how it was seen as a technique for modernizing objects totally — gracing them with the "cleaner" lines associated with modern design, on the one hand, and efficiency, hygiene and style on the other.

Characteristic of streamlined design is the production of continuous, sculptural forms that minimize mechanical joints and eliminate hinges, bolts and screws. This aspiration toward seamlessness in streamlined design is usually achieved through the processes of stamping, molding and extrusion — each of these processes requires a "body" from which, or into which, the finished product will take its shape: sheet material is struck against the exterior of the body, a liquid material is poured into the interior of the body or a malleable substance is forced through a shaped aperture.[36] A less technical means of streamlining is evident in a 1935 girdle advertisement that portrays a woman whose garment has the metallic sheen and rigid definition of stamped metal. The ad copy boasts that Flexees "actually streamline the figure, transforming wayward curves and bulges into smart and flattering lines." As with Loewy's evolution chart of design, the female form is represented as yet another raw material upon which industrial culture will leave its stamp.

Unlike traditional industrial products, which were bolted together out of discrete parts, such



1. Dymaxion Bathroom, interior view. 2. Dymaxion Dwelling Machine, top interior view. 3. Wichita House, view of central masthead, 1945. 4. Wichita House, full assembly, 1945. 5. View of Main Assembly floor of Beech Aircraft where the Wichita House was to be produced, 1945.

Buckminster Fuller.

c 1960 Estate of Buckminster Fuller. Courtesy, Buckminster Fuller Institute, Los Angeles.

stamped or molded forms took their shape from a negative. As in a photograph, a potential infinity of copies can be cast from a single negative, and the uniform surface of the object is unbroken by such syntactical connectors as bolts, rivets and joints. Laszlo Moholy-Nagy, director of the "New Bauhaus" in Chicago in the late 1930s and early 1940s, was fascinated by the seamless, organic character of streamlining, although he was critical of its decorative, emotional application to mass consumer goods.[37] Moholy proposed the manufacture of stamped objects from continuous pieces of material: for example, "furniture, molded without joints" and "clothing, cast, pressed or molded in one piece."[38] Such objects complemented Moholy's interest in indexical signs as the basis for a "language of vision" grounded in material phenomena: a tire track in the snow, a smear of light on photosensitive paper, the cracks and bubbles of peeling paint.[39]

Streamlining generalizes a machine, concealing its constituent moving parts inside a continuous, sculpted shell, which renders them, thereafter, "internal" components and initiates a distinction between inside and outside. Such industrial skins discourage the user from intervening in a machine's inner regions, and thereby domesticate and anthropomorphize it. As Paul Frankl asserted, "Simple lines tend to cover up the complexity of the machine age. If they do not do this, they at least direct our attention and allow us to feel master of the machine."[40] Similarly, the package and product designer Ben Nash wrote in 1945:

> The automobile designers and manufacturers have achieved the task of making it possible for consumers to practically live in a vehicle of transportation, almost unconscious of its being a piece of complicated mechanism. In brief, the mechanical aspects have been made entirely unobtrusive....[41]

The machine with which people traveled between architectural spaces had itself become a naturalized element of the domestic environment, a machine for living in.

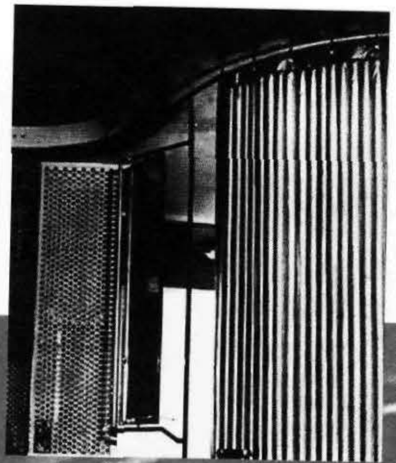
Not surprisingly, machines and objects also took on bodily aspects. Loewy was certainly aware of the anthropomorphic quality of his design: his autobiography invokes the body of Betty Grable, "whose liver and kidneys are no doubt adorable, though I would rather have her with skin than without."[42] Loewy courts a coy Freudianism by titling a chapter of his autobiography "Sex and the Locomotive," and he reveals that it was on a train that he was first kissed. Loewy also rhapsodizes on the Coke bottle:

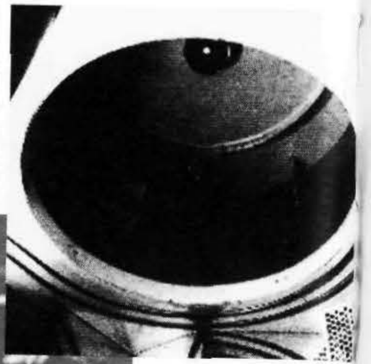
> Even when wet and cold, its twin-sphered body offers a delightful valley for the friendly hold of one's hand, a feel that is cozy and luscious. It is interesting to watch the almost caressing, affectionate way with which the average teenager fondles his Coke bottle.[43]

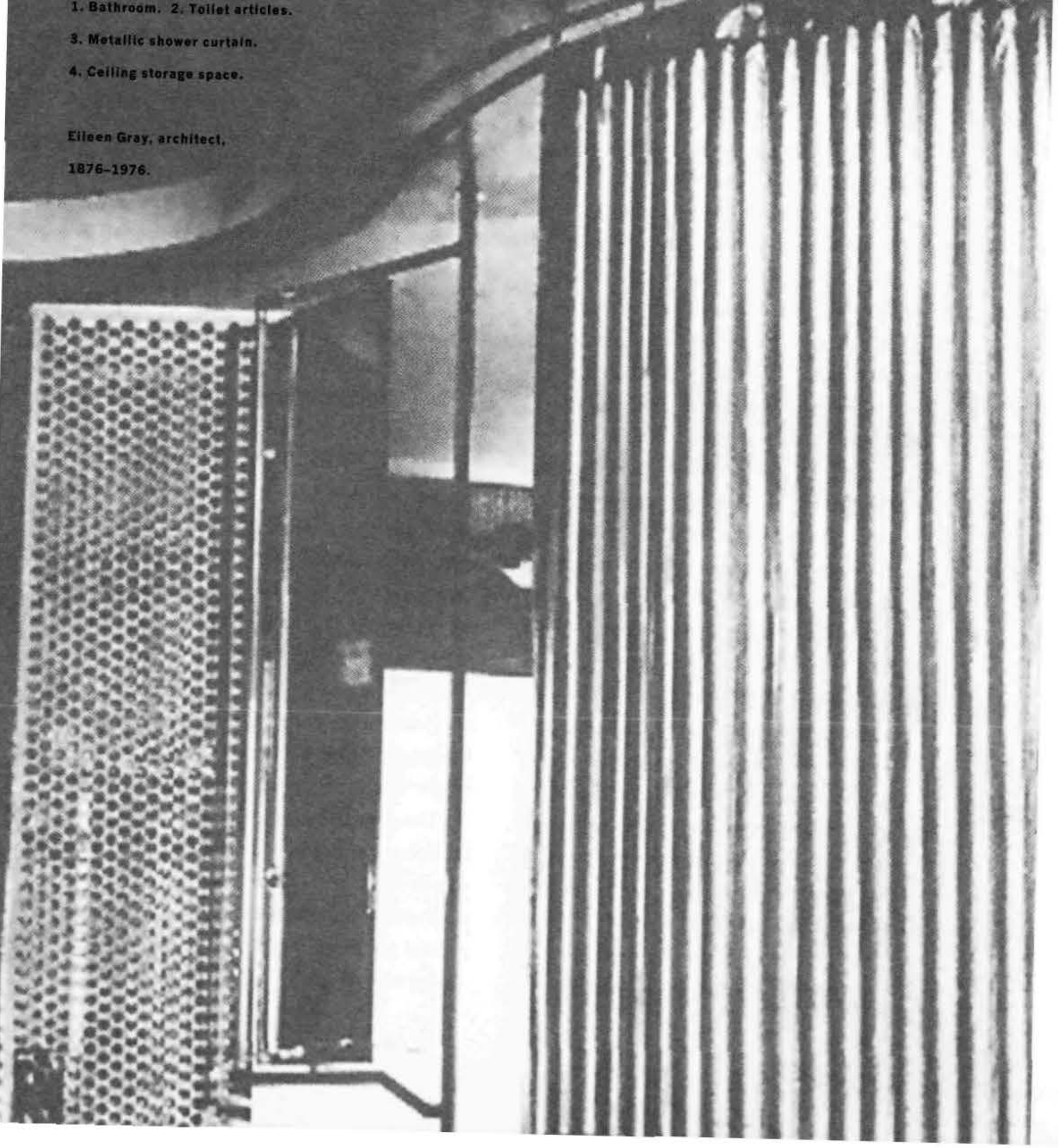
Such innuendos are reiterated by publicity shots of Loewy astride his steam engines.

In the literature of streamlining, phallic imagery is a commonly accepted subtext: for example, in the first chapter of his recent book *The Streamlined Decade*, "The Science of Penetration," Donald Bush frequently mentions the predominance of tapered, conical and cylindrical forms in the vocabulary of 1930s design.[44] Yet the reduction of streamlined imagery to a phallic theme overlooks another corporeal process, a surreal conflation of the man-made and the natural: the finely wrought industrial object whose complex curvature conforms to notions of the "organic" rather than to the mechanical. This organicism was supported by the production/waste ethos of modern marketing: product lifespan, decay and obsolescence were critical to the "health" of the economic cycle.

The accelerated "production" of modern consumer culture was accompanied by a renewed attention to all forms of waste. A concern with wasted labor, time and space in the form of purportedly labor-, space- and time-saving devices and procedures masked a







1. Bathroom. 2. Toilet articles.

3. Metallic shower curtain.

4. Ceiling storage space.

Eileen Gray, architect,

1876–1976.

rapidly expanding regime of bodily and domestic caretaking; while new products promised to "save" time, they were part of an increasingly demanding routine of housekeeping and grooming chores. The cleanliness imperative was mirrored by the rhythmic accumulation and disposal of new products — from "durables" such as vacuum cleaners and garbage disposals to expendables such as soap, mouthwash, deodorant, floor polish, air freshener and tissues. Just as socially valued character traits like orderliness and cleanliness drew upon sublimated excremental pleasures, the unprecedented cleanliness promoted by the emerging consumer culture was complemented by a secondary preoccupation with waste. The attention to dust, sweat, bad breath, cooking odors and the innumerable germs hiding in the cracks and crevices of the home was as much a process of *objectification* as of elimination — making visible what had once been invisible, bringing to the surface that which had been "hidden."

Christine Frederick's injunction "creative waste" was a succinct formulation of the emerging "logic" that brought together the contradictory imperatives of production and elimination by figuring waste as a mode of making; the period's euphoric elevation of garbage was complemented by the emergence of rigorous new standards of hygiene. The psychoanalytic literature on anal eroticism has theorized the coexistence of these apparent oppositions — production and waste, cleanliness and filth — as part of the process of socializing individuals: a child fascinated with his or hers own excrement learns to sublimate this urge into character traits such as orderliness, fastidiousness and cleanliness.[45]

As has recently been shown, the marketing and advertising industry was familiar with Freud's *Civilization and Its Discontents*. Egmont Arens notes in his 1932 manifesto, *Consumer Engineering*, that touch is one of the "sublimated" senses of modern culture, and that product and package designers can profit from subtle appeals to the forgotten pleasures of tactility.[46] Designers of the 1920s and 1930s generated products and packages with skins alluringly soft or hard, crisp or curved, glossy or grained, slippery or matte, convex or concave. Unlike the "objective" senses of sight and hearing, tactility involves immediate contact between body and product; it is akin, rather, to taste and smell, which involve the incorporation of the object by the body.

The "sublimated" sense of touch exploited by modern design was one form of a large and even more deeply sublimated aesthetic of anal eroticism. Tactility is part of the child's pleasure in handling his or her own excrement, a forbidden pleasure gradually displaced to progressively abstracted substances: from sand, clay and rubber to pebbles, marbles and coins.[47] An analogous progression from soft to hard — and with it an entry into the economy — is embodied in the organically curved yet hard, enclosed forms of streamlined products, whose models typically were molded out of soft clay and then cast or stamped out of metal or plastic — rigid, nonporous substances impervious to change and resistant to grime.

These contradictory reactions to human waste find their common ground in anal eroticism: in disgust, manifested in stinginess, fastidiousness, organizational compulsiveness, and a general "withholding" or "holding in"; and a delight, manifested in artistic production, generosity and a general "giving out."[48] Objects like Loewy's streamlined pencil sharpener embody an attenuated form of just such a contradictory aesthetic of waste; their molded, sculptural forms reflect the pleasure in manipulating plastic materials as well as a fastidious interest in concealing a messy interior behind a clean, "streamlined" body. And while contemporary and recent discussions of streamlining have revealed a sophistication about "Freudian" symbolism, the referent is assumed to be phallic.[49] These objects, though, also resemble the biologically extruded forms of feces, the child's first work of art. This additional referent, summarized by the phrase "creative waste," better accounts for the coexistence of a fetishized cleanliness and an economy that values the rhythmic disposal of products as an almost biological imperative.

The nexus of hygiene, waste and efficiency, conflated in streamlining, as an aesthetic and an ideology, is expressed well in a 1937 ad for the laxative Petrolagar. The text describes a modern metropolis where "high speed living" and "unfavorable eating and working conditions" make unhealthy demands on the human body: "The bowel, like a modern railway, must have a regular schedule of operation." This is a comparison that Raymond Loewy never invited.

Notes

1. For monographic studies of Loewy's career, see Raymond Loewy, *Industrial Design* (Woodstock, N.Y.: Overlook Press, 1979), and Angela Schonberger, ed., *Raymond Loewy: Pioneer of American Industrial Design* (Munich: Prestel, 1990).

2. For a review of sewage and sanitation in urban America, see Stanley K. Schultz and Clay McShane, "To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late-Nineteenth-Century America," *Journal of American History* 65.2 (Sept. 1978), pp. 389–411. Schultz and McShane explain that the comparatively late development of urban services such as sanitation and water supply is attributable to the decentralized structure of municipal government, whose authority was undercut by real estate speculators who parceled territory and land use.

3. The late and uneven development of water supply is also attributable to the fact that before municipal control, it was often available only to individuals or neighborhoods able either to influence local politicians or to pay companies and individuals for the use of private water supplies. See May Stone, "The Plumbing Paradox," *Winterthur Portfolio* 14.3 (1979), pp. 283–309.

4. As late as 1940, 93.5 percent of the dwellings in urban America had running water, 83 percent were equipped with indoor toilets, and 77.5 percent had bathing arrangements. Of the more than 40 percent of Americans living in rural areas, 17.8 percent of the homes had running water and 11.2 percent had toilets and bathtubs. Gail Caskey Winkler, *The Well-Appointed Bath* (Washington, D.C.: Preservation Press and The National Trust for Historic Preservation, 1989), p. 11.

5. Histories of the bathroom include, in addition to those cited above, Lawrence Wright, *Clean and Decent: The Fascinating History of the Bathroom and Water Closet and of Sundry Habits, Fashions, and Accessories of the Toilet Principally in Britain, France and America* (New York: Viking, 1960); Sigfried Giedion, *Mechanization Takes Command: A Contribution to Anonymous History* (New York: W. W. Norton, 1975); Alexander Kira, "Sanitation: A Historical Survey," *The Architect's Journal* (April 3, 1937); Reginald Reynolds, *Cleanliness and Godliness or The Further Metamorphosis* (Garden City, N.Y.: Doubleday, 1946); and Bernard Rudofsky, "Uncleanliness and Ungodliness," *Interior Design* (June 1984), pp. 212–21.

6. "Bathrooms and Civilization," *House and Garden* 30.2 (Feb. 1917), p. 90.

7. Adrian Forty describes the relationship between hygiene and germ theory in his chapter "Hygiene and Cleanliness," in *Objects of Desire* (New York: Pantheon, 1986), pp. 156–81. For a more extensive overview, see Daniel M. Fox, *Health Policies and Health Politics: The British and American Experience, 1911–1965* (Princeton: Princeton University Press, 1986). Studies of the popular reception of health and hygiene reform include Andrew McClary, "Germs Are Everywhere: The Germ Threat as Seen in Magazine Articles, 1890–1920," *Journal of American Culture* 3.1 (Spring 1980), pp. 33–46; and John C. Burnham, *How Superstition Won and Science Lost: Popularizing Science and Health in the United States* (New Brunswick, N.J.: Rutgers University Press, 1987).

8. A history of domestic appliances that focuses on design is Penny Sparke, *Electrical Appliances, Twentieth Century Design* (New York: Dutton, 1987). The impact of domestic technology on housework is chronicled by Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1983); Giedion, *Mechanization Takes Command*; Susan Strasser, *Never Done: A History of American Housework* (New York: Pantheon, 1982); and Christina Hardyment, *From Mangle to Microwave: The Mechanization of the Household* (Cambridge, Mass.: Polity Press and Basil Blackwell, 1988). A schematic history of the American kitchen, documented with contemporary advertisements, is Jane Celehar, *Kitchens and Kitchenware* (Lombard, Ill.: Wallace Homestead, 1985). On kitchen ranges, see Jane Busch, "Cooking Competition: Technology on the Domestic Market in the 1930s," *Technology and Culture* 24.2 (April 1938), pp. 222–45. American domestic architecture, including its kitchens, is chronicled in two books by Gwendolyn Wright: *Moralism and the Modern Home: Domestic Architecture and Cultural Conflict in Chicago, 1873–1913* (Chicago: University of Chicago Press, 1980), and *Building the American Dream: A Social History of Housing in America* (Cambridge, Mass.: MIT Press, 1981).

9. Works by Catharine Beecher on home economy include *Treatise on Domestic Economy, for the Use of Young Ladies at Home, and at School* (Boston: Marsh, Capon, Lyon, and Webb, 1841), and "How To Redeem Woman's Profession from Dishonor," *Harper's New Monthly Magazine* (1865), pp. 710–16. Catharine Beecher and Harriet Beecher Stowe collaborated on the 1869 *American Woman's Home, or, Principles of Domestic Science, Being a Guide to the Formation and Maintenance of Economical, Healthful, Beautiful, and Christian Homes* (Hartford, Conn.: Stowe-Day Foundation, 1985).

10. Beecher and Beecher Stowe, *American Woman's Home*, p. 34.

11. Christine Frederick, *Household Engineering: Scientific Management in the Home* (Chicago: American School of Home Economics, 1920). Other "scientists" of domestic labor of the period include Lillian Gilbreth and Ellen Richards. See Gilbreth, *Management in the Home: Happier Living through Saving Time and Energy* (New York: Dodd, Mead, 1959); and Richards, *Euthenics: The Science of Controllable Environment* (Boston: Barrows, 1929). Domestic work is compared to factory labor in Mary Ormsbee Whitton, "The Eight Hour Kitchen," *House and Garden* 38.2 (Aug. 1920), pp. 19–21, 81. Anson Rabinbach evaluates the time-and-motion movement in the European context, in *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990).

12. Dolores Hayden, *The Grand Domestic Revolution: A History of Feminist Designs for American Homes, Neighborhoods, and Cities* (Cambridge, Mass.: MIT Press, 1981), p. 285.

13. Penny Sparke discusses Frederick's theories in relation to German design in *Electrical Appliances* (New York: E.P. Dutton, 1987). John Heskett also suggests that the continuous-surface kitchen originated in Germany, inspired in part by American motion studies, in *Industrial Design* (New York and Toronto: Oxford University Press, 1980), pp. 80–84. The concept of a coordinated, fully built-in kitchen was part of the literature, if not the reality, of American domestic design, as shown by the prophetic designs of the Beecher sisters and by articles in the early 1920s such as Kate Hammond, "The Permanent Kitchen," *House and Garden* 38.2 (Aug. 1920), p. 51; and Ethel R. Peyser,

"Furnishing Your Kitchen," *House and Garden* 38.3 (Sept. 1920), pp. 56–57, 76, 78, 82.

14. Bruno Taut, *Die Neue Wohnung, Die Frau als Schoüpferin* (Leipzig: Klinkhardt and Biermann, 1926).

15. Jeffrey L. Meikle, *Twentieth Century Limited: Industrial Design in America, 1925–1939* (Philadelphia: Temple University Press, 1979), p. 102; and Arthur Pulos, *American Design Ethic: A History of American Design to 1940* (Cambridge, Mass.: MIT Press, 1983), p. 358.

16. Harvey A. Levenstein, *Revolution at the Table: The Transformation of the American Diet* (New York and Oxford: Oxford University Press, 1988), pp. 35, 37.

17. Afred D. Chandler describes the rise of the modern food corporation in *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Mass.: Belknap Press, 1977), chs. 7 and 9. A pictorial catalogue of American brandnames is Hal Morgan, *Symbols of America* (New York: Penguin, 1987). On food processing, see Samuel C. Prescott and Bernard E. Proctor, *Food Technology* (New York: McGraw-Hill, 1945). An early report on quick-freezing, noting its packaging benefits, is Allan Shephard, "The Quick-Freezing Process and the Distribution of Frozen Foods," *Harvard Business Review* 8.3 (April 1930), pp. 339–45. On changes in grocery store design, see Chester L. Liebs, *Mainstreet to Miracle Mile: American Roadside Architecture* (Boston: Little, Brown, 1985). Textbooks on package design include Richard Franken and Carroll B. Larrabee, *Packages that Sell* (New York: Harper, 1928); and Carroll B. Larrabee, *How To Package for Profit: A Manual for Packaging* (New York: Harper, 1935).

18. The ideology of consumerism is summarized and celebrated in Daniel J. Boorstin, "Welcome to the Consumption Community," *Fortune* 76 (1967), pp. 118–38.

19. In Roy Sheldon and Egmont Arens, *Consumer Engineering, A New Technique for Prosperity* (New York: Harper, 1932), p. 32.

20. See Roland Marchand, *Advertising the American Dream* (Berkeley: University of California Press, 1985).

21. Frederick uses the term "creative waste" in *Selling Mrs. Consumer* (New York: The Business Bourse, 1929). Numerous texts written in the 1920s and 1930s voiced this ethos: for example, "It's up to the Women: The Movement Started by the Journal Is Sweeping the Country," *Ladies Home Journal* (April 1932), compares the shopping habits of "Mrs. Depression" and "Mrs. Prosperity." The social historian Winifred Wandersee has demonstrated that women were indeed spending a great deal during the Depression, often struggling to maintain the "standards of living" that emerged during the 1920s. Many married women went to work in order to support new "necessities" such as electric appliances and automobiles. See Wandersee, *Women's Work and Family Values, 1920–1940* (Cambridge, Mass.: Harvard University Press, 1981).

22. Beecher, *Treatise on Domestic Economy*, p. 161.

23. *The Standard Edition of the Complete Psychological Work of Sigmund Freud*, ed. James Strachey, (London: Hogarth, 1953), vol. 7, pp. 173–200.

24. Verna Cook Salomonsky, "Putting the Service Entry To Work," *House and Garden* 41.1 (Jan. 1922), p. 51.

25. Michel Foucault, *Discipline and Punish: The Birth of the Prison*, trans. Alan Sheridan (New York: Vintage, 1979).

26. See Fred DeArmond, *The Laundry Industry* (New York: Harper, 1950).

27. For mechanization as liberation, see Giedion, *Mechanization Takes Command*, Pulos, *American Design Ethic*, and Heskett, *Industrial Design*; for mechanization as intensified drudgery, see Cowan, *More Work for Mother*, and Strasser, *Never Done*.

28. Works discussing the role of consumption in American housework include Cowan, cited above, and her earlier essay "The 'Industrial Revolution' in the Home: Household Technology and Social Change in the Twentieth Century," *Technology and Culture* 17.1 (Jan. 1976), pp. 1–23. See also John Kenneth Galbraith, *Economics and the Public Purpose* (Boston: Houghton Mifflin, 1973); and Christine Kleinegger, "Out of the Barns and into the Kitchens: Transformations in Farm Women's Work in the First Half of the Twentieth Century," in Barbara Drygulski et al., eds., *Women, Work, and Technology: Transformations* (Ann Arbor: University of Michigan Press, 1987), pp. 162–81.

29. For a review of the literature on the economic status of housework, see Nona Glazer-Marlbin, "Housework," *Signs: Journal of Women in Culture and Society* 1.4 (1976), pp. 905–22. For a discussion of the status of housework in Marxist terms, see Terry Fee, "Domestic Labor: An Analysis of Housework and Its Relation to the Production Process," *Review of Radical Economics* (Spring 1976), pp. 61–68. Phyllis Palmer's book *Domesticity and Dirt: Housewives and Domestic Servants in the United States, 1920–1945* (Philadelphia: Temple University Press, 1984) asserts that more middle-class women had servants during the interwar period than is commonly thought, and that the high standards of housekeeping inherited from that period are based on the ideal of a house with servants.

30. Meikle, *Twentieth Century Limited*, pp. 104–107.

31. Raymond Loewy, *Never Leave Well Enough Alone* (New York: Simon and Schuster, 1951), p. 219.

32. Elaine Scarry, *The Body in Pain: The Making and Unmaking of the Material World* (New York and Oxford: Oxford University Press, 1985).

33. See Donald J. Bush, *The Streamlined Decade* (New York: Braziller, 1975), pp. 4–14.

34. Pulos, *American Design Ethic*, p. 395.

35. Quoted in Meikle, *Twentieth Century Limited*, p. 72.

36. For a brief history of plastic, see E. G. Couzens and V. E. Yarsley, *Plastics in the Modern World* (Baltimore: Penguin, 1968). For a discussion of industrial plastics forming techniques, see Clark N. Robinson, *Meet the Plastics* (New York: Macmillan, 1949).

37. Laszlo Moholy-Nagy, *Vision in Motion* (Chicago: Paul Theobold, 1969).

38. Ibid., pp. 51–54.

39. See Ellen Lupton, "Visual Dictionary," in Lupton and J. Abbott Miller, eds., *The Bauhaus and Design Theory* (New York: The Cooper Union and Princeton Architectural Press, 1990), pp. 22–33.

40. Quoted in Meikle, *Twentieth Century Limited*, p. 153.

41. Ben Nash, *Developing Marketable Products and Their Packaging* (New York: McGraw-Hill, 1945), p. 87.

42. Loewy, *Never Leave Well Enough Alone*, p. 220.

43. Loewy, *Never Leave Well Enough Alone*, p. 297.

44. See also Karal Ann Marling and Donald J. Bush, "Autoeroticism," *Design Quarterly* 146 (1989).

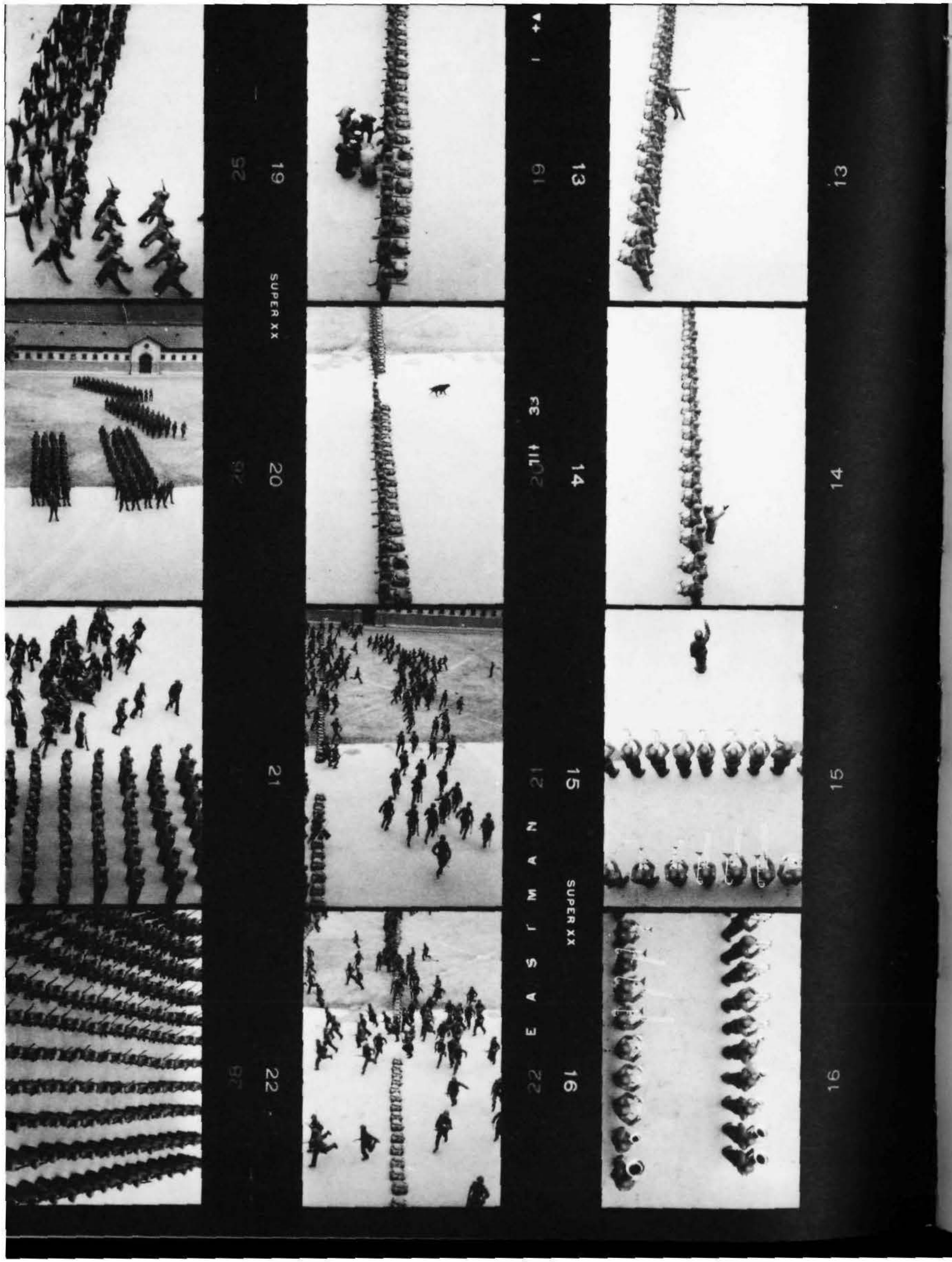
45. Sigmund Freud, *Civilization and Its Discontents*, ed. and trans. James Strachey (New York: W. W. Norton, 1961), pp. 43–45.

46. Stuart Ewen, *All Consuming Images: The Politics of Style in Contemporary Culture* (New York: Basic Books, 1988), pp. 49–50.

47. Sandor Ferenczi, "The Ontogenesis of the Interest in Money," in Ferenczi and Otto Rank, *Sex in Psycho-Analysis* (New York: Dover, 1956), pp. 269–79.

48. Ernest Jones, *Papers on Psychoanalysis* (Boston: Beacon, 1961).

49. Richard Pommer acknowledges the sexual, yet strictly phallic, implications of streamlining in "Loewy and the Industrial Skin Game."



Photographs by René Burri

Techniques of the Body [1934]

Marcel Mauss

Introduction

I use the term "body techniques" in the plural advisedly because it is possible to produce a theory of the technique of *the* body on the basis of a study, an exposition, a description pure and simple of techniques of the body in the plural. By this expression I mean the ways in which, from society to society, men know how to use their bodies. In any case, it is essential to move from the concrete to the abstract and not the other way around.

I want to convey to you what I believe to be one of the parts of my teaching that is not to be found elsewhere, which I have rehearsed in a course of lectures on descriptive ethnology (the books containing the *Summary Instructions* and *Instructions for Ethnographers* are to be published[1]) and have tried out several times in my teaching at the Institute of Ethnology of the University of Paris.

When a natural science makes advances, it does so only in the direction of the concrete and always in the direction of the unknown. Now, the unknown is found at the frontiers of the sciences, where the professors are at each other's throats, as Goethe put it (though he did so less politely). It is generally in these ill-demarcated domains that the urgent problems lie. However, these uncleared lands are marked. In the natural sciences, at present, there is always one obnoxious rubric. There is always a moment when, the science of certain facts not yet being reduced to concepts, the facts not even being grouped together organically, these masses of facts receive that signpost of ignorance: "miscellaneous." This is where we have to penetrate. We can be certain that this is where there are truths to be discovered: first, because we know that we are ignorant, and second, because we have a lively sense of the quantity of the facts. For many years in my course in descriptive ethnology, I have had to teach in the shadow of the disgrace and opprobrium of the "miscellaneous," in a matter in which, in ethnography, this rubric was truly heteroclite. I was well aware that walking or swimming, for example, and all sorts of things of the same type are specific to determinate societies; that the Polynesians do not swim as we do, that my generation did not swim as the present generation does. But what social phenomena did these represent? They were "miscellaneous" social phenomena, and, since this rubric is such a horrible one, I have often thought about this "miscellaneous" — at least as often as I have been obliged to discuss it, and often in between.

Forgive me if, in order to give shape to this notion of body techniques for you, I tell you about the occasions on which I pursued this general problem and how I managed to pose it clearly. It was a series of steps taken consciously and unconsciously.

First, in 1898, I came into contact with someone whose initials I still know, but whose name I can no longer remember (I have been too lazy to look it up). It was the man who wrote an excellent article on swimming for the 1902 edition of the *Encyclopaedia Britannica*, then in preparation.[2] (The articles on swimming in the two later editions are not so good.) He revealed to me the historical and ethnographic interest of the question. It was a starting point, an observational framework. Subsequently — I noticed it myself — we have seen swimming techniques undergo a change in our generation's lifetime. An example will put us in the picture straightaway: us, the psychologists, as well as the biologists and sociologists. Previously, we were taught to dive after having learned to swim. And when we were learning to dive, we were taught to close our eyes and then to open them underwater. Today the technique is the other way around. The whole training begins by getting the children accustomed to keeping their eyes open underwater. Thus, even before they can swim, particular care is taken to get the children to control their dangerous but instinctive ocular reflexes; before all else they are familiarized with the water, their fears are suppressed, a certain confidence is created, suspensions and movements are selected. Hence, there is a technique of diving and a technique of education in diving that have been discovered in my day. And you can see that it really is a technical education and, as in every technique, there is an apprenticeship in swimming. On the other hand, our generation has witnessed a complete change in technique: we have seen the breaststroke with the head out of the water replaced by the different sorts of crawl. Moreover, the habit of swallowing water and spitting it out again has gone. In my day, swimmers thought of themselves as a kind of steamboat. It was stupid, but in fact I still do this: I cannot get rid of my technique. Here, then, we have a specific technique of the body, a gymnastic art perfected in our own day.

But this specificity is characteristic of all techniques. For example, during the war I was able to make many observations on this specificity of techniques, in particular, the technique of *digging*. The English troops I was with did not know how to use French spades, which forced us to change eight thousand spades per division when we relieved a French division, and vice versa. This plainly shows that a manual knack can only be learned slowly. Every technique, properly so called, has its own form.

But the same is true of every attitude of the body. Each society has its own special habits. In the same period, I had many opportunities to note the differences between the various armies. An anecdote about *marching*: You all know that the British infantry marches with a step different from the French — with a different frequency and a different stride. For the moment, I am not talking about the English swing or the action of the knees and so on. The Worcester Regiment, having achieved considerable glory alongside French infantry in the Battle of the Aisne, requested royal permission to have French trumpets and drums, a band of French buglers and drummers. The result was not very encouraging. For nearly six months, in the streets of Bailleul, long after the Battle of the Aisne, I often saw the following sight: the regiment had preserved its English march but had set it to a French rhythm. It even had at the head of its band a little French light infantry regimental sergeant major who could blow the bugle and sound the march even better than his men. The unfortunate regiment of tall Englishmen could not march. Their gait was completely at odds. When they tried to march in step, the music would be out of step, with the result that the Worcester Regiment was forced to give up its French buglers. In fact, the bugle calls adopted earlier, army by army, in the Crimean War, were the calls "at ease" and "retreat." Thus, I often saw, in a very precise fashion, not only in the ordinary march, but also in the double and so on, the differences in elementary as well as sporting techniques between the English and the French. Professor Curt Sachs, who is living here in France at present, made the same observation. He has discussed it in several of his lectures. He could recognize the gait of an Englishman and a Frenchman from a long distance.

But these were only approaches to the subject.

A kind of revelation came to me in the hospital. I was ill in New York. I wondered where I had seen girls walking the way my nurses walked. I had the time to think about it. At last I realized that it was in movies. Returning to France, I noticed how common this gait was, especially in Paris; the girls were French and they too were walking in this way. In fact, American walking fashions had begun to arrive over here, thanks to the movies. This was an idea I could generalize. The positions of the arms and hands while walking form a social idiosyncrasy — they are not simply a product of some purely individual, almost completely psychic, arrangements and mechanisms. For example, I think I can also recognize a girl who has been raised in a convent. In general, she will walk with her fists closed. And I can still remember my third-form teacher shouting at me: "Idiot! Why do you walk around the whole time with your hands flapping wide open?" Thus, there exists an education in walking, too.

Another example: There are polite and impolite *positions for the hands* at rest. Thus, you can be certain that if a child at table keeps his elbows in when he is not eating, he is English. A young Frenchman has no idea how to sit up straight; his elbows stick out sideways; he puts them on the table and so on.

Finally, in *running*, too, I have seen, you all have seen, the change in technique. Imagine, my gymnastics teacher, one of the top graduates of Joinville around 1860, taught me to run with my fists close to my chest — a movement completely contradictory to all running movements. I had to see the professional runners of 1890 before I realized the necessity of running in a different fashion.

Hence, I have had this notion of the social nature of the habitus for many years. Please note that I use the Latin word — it should be understood in France — "*habitus*." The word translates infinitely better than "*habitude*" (habit or custom), the "*exis*," the "acquired ability" and "faculty" of Aristotle (who was a psychologist). It does not designate those metaphysical *habitudes*, that mysterious memory, the subjects of volumes or short and famous theses. These "habits" do not vary just with individuals and their imitations; they vary especially between societies, educations, proprieties and fashions, types of prestige. In them, we should see the techniques and work of collective and individual practical reason rather than, in the ordinary way, merely the soul and its repetitive faculties.

Thus, everything tended toward the position that we in this society are among those who have adopted, following Auguste Comte's example: the position of Georges Dumas, for example, who, in the constant shuttlings between the biological and the sociological, leaves but little room for the psychological mediator. And I concluded that it was not possible to have a clear idea of all these facts about running, swimming and so on, unless one introduced a triple consideration instead of a single consideration — be it mechanical and physical, like an anatomical and physiological theory of walking, or on the contrary psychological or sociological. It is the triple viewpoint, that of the total man, that is needed.

Finally, another series of facts impressed itself upon me. In all these elements of the art of using the human body, the facts of *education* are dominant. The notion of education could be superimposed on that of imitation. For there are particular children with very strong imitative faculties, others with very weak ones, but all of them go through the same education, such that we can understand the continuity of the concatenations. What takes place is a prestigious imitation. The child, the adult, imitates actions that have succeeded, which he has seen successfully performed by people in whom he has confidence and who have authority over him. The action is imposed from without, from above, even if it is an exclusively biological action, involving his body. The individual borrows the series of movements of which he is composed from the action executed in front of him, or with him, by others.

It is precisely this notion of the prestige of the person who performs the ordered, authorized, tested action vis-à-vis the imitating individual, that contains all the social element. The imitative action that follows contains the psychological element and the biological element.

The whole, the ensemble, though, is conditioned by the three elements indissolubly mixed together.

All this is easily linked to a number of other facts. In a book by Elsdon Best that reached here in 1925, there is a remarkable document on the way Maori women in New Zealand walk. (Do not say that they are primitives, for in some ways I think they are superior to the Celts and Germans.)

> Native women adopted a peculiar gait [the English word is delightful] that was acquired in youth, a loose-jointed swinging of the hips that looks ungainly to us, but was admired by the Maori. Mothers drilled their daughters in this accomplishment, termed *onioni*,

and I have heard a mother say to her girl: "*Ha! Kaore koe e onioni*" ("you are not doing the *onioni*") when the young one was neglecting to practise the gait.[3]

This was an acquired, not a natural way of walking. To sum up, there is perhaps no "natural way" for the adult. A fortiori when other technical facts intervene: to take ourselves, the fact that we wear shoes to walk transforms the positions of our feet: we certainly feel it when we walk without them.

On the other hand, this same basic question arose for me in a different region, vis-à-vis all the notions concerning magical power, beliefs in the not only physical but also moral, magical and ritual effectiveness of certain actions. Here I am perhaps even more on my own terrain than on the adventurous terrain of the psychophysiology of modes of walking, which is a risky one for me in this company.

Here is a more "primitive" fact, Australian this time: a ritual formula for both hunting and running. As you well know, the Australian manages to outrun kangaroos, emus and wild dogs. He manages to catch the opossum at the top of its tree, even though the animal puts up a remarkable resistance. One of these running rituals, observed a hundred years ago, is that of the hunt for the dingo, or wild dog, among the tribes near Adelaide. The hunter constantly shouts the following formula:

> Strike [him, i.e., the dingo] with the tuft of eagle feathers [used in initiation, etc.]
> Strike [him] with the girdle
> Strike [him] with the string round the head
> Strike [him] with the blood of circumcision
> Strike [him] with the blood of the arm
> Strike [him] with menstrual blood.
> Send [him] to sleep, etc.[4]

In another ceremony, that of the opossum hunt, the individual carries in his mouth a piece of rock crystal (*kawemukka*), a particularly magical stone, and chants a formula of the same kind, and it is with this support that he is able to dislodge the opossum, that he climbs the tree and can stay hanging on to it by his belt, that he can outlast and catch and kill this difficult prey.

The relations between magical procedure and hunting techniques are clear, too universal to need to be stressed.

The psychological phenomenon I am reporting at this moment is clearly only too easy to grasp and understand from the normal viewpoint of the sociologist. But what I want to get at now is the confidence, the psychological *momentum* that can be linked to an action that is primarily a fact of biological resistance, obtained thanks to some works and a magical object.

Technical action, physical action, magicoreligious action are confused for the actor. These are the elements I had at my disposal.

All this did not satisfy me. I saw how everything could be described but not how it could be organized; I did not know what name, what title, to give it all.

It was very simple, I had just to refer to the division of traditional actions into techniques and rites, which I believe to be well founded. All these modes of action were techniques, the techniques of the body.

I made, and went on making for several years, the fundamental mistake of thinking that there is technique only when there is an instrument. I had to go back to ancient notions, to the platonic position on technique, for Plato spoke of a technique of music and in particular of a technique of dance, and I had to extend these notions.

I call "technique" an action that is *effective* and *traditional* (and you will see that in this it is no different from a magical, religious or symbolic action). It has to be *effective* and *traditional*. There is no technique and no transmission in the absence of tradition. This, above all, is what distinguishes man from the animals: the transmission of his techniques, and very probably their oral transmission.

Allow me, therefore, to assume that you accept my definitions. But what is the difference between the effective traditional action of religion, the symbolic or juridical effective traditional action, the actions of life in common, moral actions on the one hand, and the traditional actions of technique, on the other? It is that the latter are felt by the author as *actions of a mechanical, physical or physicochemical order* and that they are pursued with that aim in view.

In this case, all that need be said is quite simply that we are dealing with *techniques of the body*. The body is man's first and most natural instrument. Or more accurately, not to speak of instruments, man's first and most natural technical object, and at the same time his first technical means, is his body. Immediately, this whole broad category of what I classified in descriptive sociology as "miscellaneous" disappeared from that rubric and took shape and body: we now know where to file it.

Before instrumental techniques there is the ensemble of techniques of the body. I am not exaggerating the importance of this kind of work, the work of psychosociological taxonomy. But it is something: order imposed on ideas where there was none before. Even inside this grouping of facts, the principle made possible a precise classification. The constant adaptation to a physical, mechanical or chemical aim (for example, when we drink) is pursued in a series of assembled actions, and assembled for the individual not by himself alone but by all his education, by the whole society to which he belongs, in the place he occupies.

Moreover, all these techniques were easily arranged in a system that is common to us, the notion basic to psychologists, particularly Rivers and Head, of the symbolic life of the mind; the notion we have of the activity of the consciousness as being, above all, a system of symbolic assemblages.

I would never stop if I tried to demonstrate to you all the facts that might be listed to make visible this concourse of the body and moral or intellectual symbols. Here let us look for a moment at ourselves. Everything in us all is under command. I am a lecturer for you; you can tell it from my sitting posture and my voice, and you are listening to me seated and in silence. We have a set of permissible or impermissible, natural or unnatural attitudes. Thus, we should attribute different values to the act of staring fixedly: a symbol of politeness in the army, and of rudeness in everyday life.

Principles of the Classification of Body Techniques

Two things were immediately apparent given the notion of techniques of the body: they are divided and vary by sex *and* by age.

Sexual division of body techniques (and not just sexual division of labor). This is a fairly broad subject. The observations of Robert Mearns Yerkes and Wolfgang Köhler on the position of objects with respect to the body (and especially to the groin) in monkeys provide inspiration for a general disquisition on the different attitudes of the moving body in the two sexes with respect to moving objects. Besides, there are classical observations of man himself on this point. They need to be supplemented. Allow me to suggest this series of investigations to my psychologist friends, as I am not very competent in this field and also my time is otherwise engaged. Take the way of *closing the fist*. A man normally closes his fist with the thumb outside, a woman with her thumb inside; perhaps because she has not been taught to do it, but I am sure that if she were taught, it would prove difficult. Her punching, her delivery of a punch, are weak. And everyone knows that a woman's throwing, of a stone for example, is not just weak but always different from that of a man: in a vertical instead of a horizontal plane.

Perhaps this is a case of two instructions. For there is a society of men and a society of women. However, I believe that there are biological and psychological things involved as well. But there again, the psychologist alone will be able to give only dubious explanations, and he will need the collaboration of two neighboring sciences: physiology and sociology.

Variation of body techniques with age.
The child normally squats. We no longer know how to. I believe that this is an absurdity and an inferiority of our races, civilizations, societies. An example: I lived at the front with Australians (whites). They had one considerable advantage over me. When we made a stop in mud or water, they could sit down on their heels to rest, and the "*flotte*," as it was called, stayed below their heels. I was forced to stay standing up in my boots with my whole foot in the water. The squatting position is, in my opinion, an interesting one that could be preserved in a child. It is a very stupid mistake to take it away from him. All mankind, excepting only our societies, has so preserved it.

It seems, besides, that in the series of ages of the human race this posture has also changed in importance. You will remember that curvature of the lower limbs was once regarded as a sign of degeneration. A physiological explanation has been given for this racial characteristic. What even Rudolf Virchow still regarded as an unfortunate degenerate, and is in fact simply what is now called "Neanderthal" man, had curved legs. This is because he normally lived in a squatting position. Hence, there are things that we believe to be hereditary, but which are in reality physiological, psychological or sociological in kind. A certain form of the tendons and even of the bones is simply the result of certain forms of posture and repose. This is clear enough. By this procedure it is possible to classify not only techniques, but also to classify their variations by age and sex.

Having established this classification, which cuts across all classes of society, we can now glimpse a third one.

Classification of body techniques according to efficiency.
Body techniques can be classified according to their efficiency, that is, according to the results of training. Training, like the assembly of a machine, is the search for, the acquisition of, an efficiency. Here it is a human efficiency. These techniques are thus human norms of human training. These procedures that we apply to animals men voluntarily apply to themselves and to their children. The latter are probably the first beings to have been trained in this way, before all the animals, which first had to be tamed. As a result, I could to a certain extent compare these techniques, them and their transmission, to training systems and rank them in the order of their effectiveness.

This is the place for the notion of dexterity, so important in psychology as well as in sociology. But in French we have only the poor term "*habile*," a bad translation of the Latin word "*habilis*," which far better designates those people with a sense of the adaptation of all their well-coordinated movements to a goal, who are practiced, who "know what they are up to." The English notions of craft or cleverness (skill, presence of mind and habit combined) imply competence at something. Once again we are clearly in the technical domain.

Transmission of the form of the techniques.
One last viewpoint: The teaching of techniques being essential, we can classify them according to the nature of this education and training. Here is a new field of studies: masses of details that have not been observed, but should be, constitute the physical education of all ages and both sexes. The child's education is full of so-called details, which are really essential. Take the problem of ambidextrousness, for example: our observations of the movements of the right hand and of the left hand are poor, and we do not know to what extent they are acquired. A pious Muslim can easily be recognized: even when he has a knife and fork (which is rare), he will go to any lengths to avoid using anything but his right hand. He must never touch his food with his left hand, or certain parts of his body with his right. To know why he does not make a certain gesture and does make a certain other gesture, neither the physiology nor the psychology of motor asymmetry in man is enough; it is also necessary to know the traditions that impose it. Robert Hertz has posed this problem correctly.[5] But reflections of this and other kinds can be applied whenever there is a social choice of the principle of movements.

There are grounds for studying all the modes of training, imitation and especially those fundamental fashions that can be called the "modes of life," the *modes*, the *tonus*, the matter, the manners, the way.

Here is the first classification, or rather, four viewpoints.

Biographical Lists of Body Techniques

Another quite different classification is, I would not say, more logical, but easier for the observer. It is a simple list. I had thought of presenting to you a series of small tables, of the kind American professors construct. I shall simply follow more or less the ages of man, the normal biography of an individual, as an arrangement of the body techniques that concern him, or that he is taught.

Techniques of birth and obstetrics.
The facts are not very well known, and much of the classical information is disputable.[6] Among the best is that of Walter Roth on the tribes of Queensland and on those of British Guiana.[7]

The forms of obstetrics are quite variable. The infant Buddha was born with his mother Māya upright and clinging to the branch of a tree. She gave birth standing up. Indian women in the main still give birth in this position. Something we think of as normal, like giving birth lying on one's back, is no more natural than doing so in other positions, such as on all fours. There are techniques of giving birth, both on the mother's part and on that of her helpers, of holding the baby, cutting and tying the umbilical cord, caring for the mother, caring for the child. Here are quite a number of questions of some importance. And here are some more: the choice of the child, the exposure of weaklings, the killing of twins are decisive moments in the history of a race. In ancient history and in other civilizations, the recognition of the child is a crucial event.

Techniques of infancy

Rearing and feeding the child: Attitudes of the two interrelated beings, mother and child. Take the child — suckling, carrying and so on. The history of carrying is very important. A child carried next to its mother's skin for two or three years has a quite different attitude to its mother from that of a child not so carried;[8] it has a contact with its mother utterly unlike our children's. It clings to her neck, her shoulder, it sits astride her hip. This remarkable gymnastics is essential throughout its life. And there is another gymnastics for the mother carrying it. It even seems that psychic states arise here that have disappeared from infancy with us. There are sexual contacts, skin contacts and so on.

Weaning takes a long time, usually two or three years. The obligation to suckle, sometimes even to suckle animals. It takes a long time for the mother's milk to run dry. Besides this, there are relations between weaning and reproduction, suspension of reproduction during weaning.[9]

Mankind can more or less be divided into people with cradles and people without. For there are techniques of the body that presuppose an instrument. Countries with cradles include almost all the peoples of the two northern hemispheres, those of the Andean region and also a certain number of Central African populations. In these last two groups, the use of the cradle coincides with a cranial deformation (which perhaps has serious physiological consequences).

The weaned child can eat and drink; it is taught to walk; it is trained in vision, hearing, in a sense of rhythm and form and movement, often for dancing and music.

It acquires the notions and practices of physical exercise and breathing. It takes certain postures that are often imposed on it.

Techniques of adolescence.

To be observed with men in particular. They are less important with girls in those societies to whose study a course in ethnology is devoted. The big moment in the education of the body is, in fact, the moment of initiation. Because of the way our boys and girls are brought up, we imagine that both acquire the same manners and postures and receive the same training everywhere. The idea is already erroneous about ourselves — and it is totally false in so-called primitive cultures. Moreover, we describe the facts as if something like our own school, beginning straightaway and intended to protect the child and train it for life, had always and everywhere existed. The opposite is the rule. For example, in all black societies, the education of the boy intensifies around the age of puberty, while that of women remains traditional, so to speak. There is no school for women. They are at school with their mothers and are trained there continuously, moving directly, with few exceptions, to the married state. The male child enters the society of men, where he learns his profession, especially the profession of arms. However, for men as well as women, the decisive moment is that of adolescence. It is at this moment that they learn definitively the techniques of the body that they will retain for the whole of their adult lives.

Techniques of adult life.

To list these we can run through the various moments of the day among which coordinated movements and suspensions of movement are distributed.

We can distinguish sleep and waking, and, in waking, rest and activity.

Techniques of sleep: The notion that going to bed is something natural is totally inaccurate. I can tell you that the war taught me to sleep anywhere, on heaps of stones, for example, but that I have never been able to change my bed without a moment of insomnia: only on the second night can I go to sleep quickly.

One thing is very simple: it is possible to distinguish between those societies that have nothing to sleep on except the "floor" and those that have instrumental assistance. The "civilization of latitude 15°" discussed by Fritz Graebner is characterized by, among other things, its use of a bench for the neck.[10] This neckrest is often a totem, sometimes carved with squatting figures of men and totemic animals. There are people with mats and people without (Asia, Oceania, part of America). There are people with pillows and people without. There are populations that lie very close together in a ring to sleep, around a fire or even without a fire. There are primitive ways of getting warm and keeping the feet warm. The people of Tierra del Fuego, who live in a very cold region, cannot warm their feet while they are asleep, because they have only one skin blanket (*guanaco*). Finally there is sleep standing up. The Masai can sleep on their feet. I have slept standing up in the mountains. I have often slept on a horse, sometimes even a moving horse: the horse was more intelligent than I was. The old chroniclers of the invasion picture the Huns and Mongols sleeping on horseback. This is still true, and the riders' sleeping does not stop the horses' progress.

There is the use of coverings, people who sleep covered and uncovered. There is the hammock and the way of sleeping while suspended.

Here are a large number of practices that are both techniques of the body and that also have profound biological echoes and effects. All this can and must be discovered.

Waking: techniques of rest: Rest can be perfect rest or a mere suspension of activity: lying down, sitting, squatting and so on. Try squatting. You will realize the torture that a Moroccan meal, for example, eaten according to all the rituals, would cause you. The way of sitting down is fundamental. You can distinguish squatting mankind and sitting mankind. And, among the latter, people with benches and people without benches and daises; people with chairs and people without chairs. Wooden chairs supported by crouching figures are widespread, curiously enough, in all the regions at 15° of latitude north and along the equator in both continents.[11] There are people who have tables and people who do not. The table, the Greek trapeza, is far from universal. Normally, it is still a carpet, a mat, throughout the East. This is all complicated, for these forms of rest include meals, conversation and so on. Certain societies take their rest in very peculiar positions. Thus, the whole of Nilotic Africa and part of the Chad region, all the way to Tanganyika, is populated by men who rest in the fields like storks. Some manage to rest on one foot without a pole, others lean on a stick. These resting techniques form real characteristics of civilization, common to a large number of them, to whole families of peoples. Nothing seems more natural to psychologists: I do not know if they would quite agree with me, but I believe that these postures in the savannah are due to the height of the grasses there and the functions of shepherd or sentry; they are laboriously acquired by education and are preserved.

You have active, generally aesthetic, rest; thus, even dancing at rest, for instance, is frequent. I shall return to this.

Techniques of activity, of movement: By definition, rest is the absence of movement, movement the absence of rest. Here is a straightforward list:

Movements of the whole body: climbing, trampling, walking.

Walking: The *habitus* of the body being upright while walking, breathing, rhythm of the walk, swinging the fists, the elbows, progression with the trunk in advance of the body or by advancing either side of the body alternately (we have grown accustomed to moving all the body forward at once). Feet turned in or out. Extension of the leg. We laugh at the goose-step. It is the way the German army can obtain the maximum extension of the leg, given in particular that all northerners, high on their legs, like to take as long a step as possible. In the absence of these exercises, we Frenchmen remain more or less knock-kneed. Here is one of those idiosyncrasies that is simultaneously a matter of race, of individual mentality and of collective mentality. Techniques such as those of the about-turn are among the most curious. The about-turn "on principle," English-style, is so different from our own that it takes considerable study to master it.

Running: Position of the feet, position of the arms, breathing, running magic, endurance. In Washington, I saw the chief of the Fire Fraternity of the Hopi Indians who had arrived with four of his men to protest against the prohibition of the use of certain alcoholic liquors in their ceremonies. He was certainly the best runner in the world. He had run 250 miles without stopping. All the Pueblos are accustomed to prodigious physical feats of all kinds. Henri Hubert, who had seen them, compared them physically with Japanese athletes. This same Indian was an incomparable dancer.

Finally, we reach techniques of active rest that are not simply a matter of aesthetics, but also of bodily games.

Dancing: You have perhaps attended the lectures of Erich von Hornbostel and Curt Sachs. I recommend to you the latter's very fine history of dancing.[12] I accept their division into dances at rest and dances in action.[13] I am less prepared to accept their hypothesis about the distribution of these dances. They are victims of the fundamental error that is the mainstay of a whole section of sociology. There are supposed to be societies with exclusively masculine descent and others with exclusively uterine descent. The uterine ones, being feminized, tend to dance on the spot; the others, with descent through the male, take their pleasure in moving around.

Sachs has better classified these dances into extrovert and introvert dances.[14] We are plunged straight into psychoanalysis, which is probably quite well founded here. In fact, the sociologist has to see things in a more complex way. Thus, the Polynesians and in particular the Maori, shake vigorously, even on the spot, or move around very energetically when they have the space to do so.

Men's dancing and women's dancing should be distinguished, for they are often opposed.

Finally, we should realize that dancing in a partner's arms is a product of modern European civilization, which demonstrates that things we find natural have a historical origin. Moreover, they horrify everyone in the world but ourselves.

I move on to the techniques of the body that are also a function of vocations and part of vocations or more complex techniques.

Jumping: We have witnessed a transformation of jumping techniques. We all jumped from a springboard and, once again, full-face. I am glad to say that this has stopped. Now people jump, fortunately, from one side. Jumping lengthways, sideways, up and down. Standing jump, pole-vault. Here I return to the objects of the reflection of my friends Köhler, Paul Guillaume and Ignace Meyerson: the comparative psychology of man and animals. I won't say anything more about it. These techniques are infinitely variable.

Climbing: I can tell you that I'm very bad at climbing trees, though reasonable on mountains and rocks. A difference of education and hence of method.

A method of getting up trees using a belt encircling the tree and the body is of prime importance among all so-called primitives. But we do not even have the use of this belt. We see telephone workers climbing with crampons, but no belt. They should be taught this procedure.[15]

The history of mountaineering methods is very noteworthy. It has made fabulous progress in my lifetime.

Descent: Nothing makes me so dizzy as watching a Kabyle going downstairs in Turkish slippers (*babouches*). How can he keep his footing without the slippers coming off? I have tried to see, to do it, but I can't understand.

Nor can I understand how women can walk in high heels. Thus, there is a lot even to be observed, let alone compared.

Swimming: I have told you what I think. Diving, swimming; use of supplementary means; air-floats, planks and so on. We are on the way to the invention of navigation. I was one of those who criticized Louis de Rougemont's book on Australia, demonstrated plagiarisms, believed he was grossly inaccurate.[16] Along with so many others, I held his story for a fable: he had seen the Niol-Niol (northwest Australia) riding cavalcades of great sea turtles. But now we have excellent photographs in which these people can be seen riding turtles. In the same way, Robert Rattray noted the story, among the Ashanti, of pieces of wood on which people swim.[17] Moreover, it has been confirmed for the natives of almost all the lagoons of Guinea and of Porto-Novo, Dahomey, in our own colonies.

Forceful movements: Pushing, pulling, lifting. Everyone knows what a back-heave is. It is an acquired technique, not just a series of movements.

Throwing, upward or along the ground and so on; the way of holding the object to be thrown between the fingers is noteworthy and undergoes great variation.

Holding. Holding between the teeth. Use of the toes, the armpit and so on.

This study of mechanical movements has gotten off to a good start. It is the formation of mechanical "pairs of elements" with the body. You will recall Franz Reuleaux's great theory about the formation of these pairs of elements.[18] And here the great name of Louis-Hubert Farabeuf will not be forgotten. As soon as I use my fist and, a fortiori, when a man had a "Chellean hand-axe" in his hand, these "pairs of elements" are formed.

This is the place for conjuring tricks, sleight of hand, athletics, acrobatics and so on. I must tell you that I had and still have a great admiration for jugglers and gymnasts.

Techniques of care for the body:
Rubbing, washing, soaping: This dossier is hardly a day old. The inventors of soap were not the ancients, they did not use it. It was the Gauls. On the other hand, independently, in the whole of Central America and the northeast of South America they soaped themselves with *quillaia* bark or "brazil," hence the name of the empire.

Care of the mouth: Coughing and spitting technique. Here is personal observation: a little girl did not know how to spit and this made every cold she had much worse. I made inquiries. In her father's village, and in her father's family in particular, in Berry, people do not know how to spit. I taught her to spit. I gave her four sous per spit. As she was saving up for a bicycle, she learned to spit. She is the first person in her family who knows how to spit.

Hygiene in the needs of nature: Here I could list innumerable facts for you.

Consumption techniques:
Eating: You will remember the story Harald Høffding repeats about the shah of Persia. The shah was the guest of Napoleon III and insisted on eating with his fingers. The emperor urged him to use a golden fork. "You don't know what a pleasure you are missing," the shah replied.

Absence and use of knives. An enormous factual error is made by W. J. McGee, who believed he had observed that the Seri (Indians of the Madeleine Peninsula, California), having no notion of knives, were the most primitive human beings. They did not have knives for eating, that is all.[19]

Drinking: It would be very useful to teach children to drink straight from the source, the fountain and so on, or from puddles of water and so on, to pour their drinks straight down their throats and so on.

Techniques of reproduction: Nothing is more technical than sexual positions. Very few writers have had the courage to discuss this question. We should be grateful to Friedrich Krauss for having published his great collection of *Anthropophyteia*.[20] Consider, for example, the technique of the sexual position consisting of this: the woman's legs hang by the knees from the man's elbows. It is a technique specific to the whole Pacific, from Australia to lower Peru, via the Behring Straits but very rare, so to speak, elsewhere.

There are all the techniques of normal and abnormal sexual acts. Contact of the sexual organs, mingling of breath, kisses and so on. Here sexual techniques and sexual morals are closely related.

Techniques of the care of the abnormal: Massages and so on. But let us move on.

General Considerations

General questions may perhaps be of more interest to you than these lists of techniques that I have paraded before you at rather too great a length.

What emerges very clearly from them is the fact that we are everywhere faced with physio-psycho-sociological assemblages of series of actions. These actions are more or less habitual and more or less ancient in the life of the individual and the history of the society.

Let us go further: One of the reasons why these series may more easily be assembled where the individual is concerned is precisely because they are assembled by and for social authority. This is how I taught, as a corporal, the reason for exercise in close order, marching four abreast and in step. Once I ordered the soldiers not to march in step drawn up in ranks and in two files, four abreast, and I obliged the squad to pass between two of the trees in the courtyard. They marched on top of one another. They realized that what they were being made to do was not so stupid. In group life as a whole, there is a kind of education of movements in close order.

In every society, everyone knows and has to know and learn what he has to do in all conditions. Naturally, social life is not exempt from stupidity and abnormalities. Error may be a principle. The French navy only recently began to teach its sailors to swim. Example and order, though, that is the principle. Hence, there is a strong sociological causality in all these facts. I hope you will accept that I am right.

On the other hand, since these are movements of the body, this all presupposes an enormous biological and physiological apparatus. What is the breadth of the linking psychological cogwheel? I deliberately say cogwheel. A Comtian would say that there is no gap between the social and the biological. What I can tell you is that here I see psychological facts as connecting cogs and not as causes, except in moments of creation or reform. Cases of invention, of laying down principle, are rare. Cases of adaptation are an individual psychological matter. In general, though, they are governed by education, and at least by the circumstances of life in common, of contact.

On the other hand, there are two big questions on the agenda for psychology: the question of individual capacities, of technical orientation, and the question of salient features, of biotypology, which may concur with the brief investigations I have just made. The great advances of psychology in the last few years have not, in my opinion, been made vis-à-vis each of the so-called faculties of psychology, but in psychotechnics, and in the analysis of psychological "wholes."

Here the ethnologist comes up against the big questions of the psychic possibilities of such a race and such a biology of such a people. These are fundamental questions. I believe that here, too, whatever the appearances, we are dealing with biologico-sociological phenomena. I think that the basic education in all these techniques consists of an adaptation of the body to their use. For example, the great tests of stoicism, which constitute initiation for the majority of mankind, have as their aim to teach composure, resistance, seriousness, presence of mind, dignity and so on. The main utility I see in my erstwhile mountaineering was this education of my composure, which enabled me to sleep upright on the narrowest ledge overlooking an abyss.

I believe that this whole notion of the education of races selected on the basis of a determinate efficiency is one of the fundamental moments of history itself: education of the vision, education in walking, ascending, descending, running. It consists especially of education in composure. And the latter is, above all, a retarding mechanism, a mechanism inhibiting disorderly movements; this retardation subsequently allows a coordinated response of coordinated movements setting off in the direction of a chosen goal. This resistance to emotional seizure is something fundamental in social and mental life. It separates, it even classifies, the so-called primitive societies according to whether they display more brutal, unreflected, unconscious reaction or, on the contrary, more isolated, precise actions governed by a clear consciousness.

It is thanks to society that there is an intervention of consciousness. It is not thanks to unconsciousness that there is an intervention of society. It is thanks to society that there is the certainty of pre-prepared movements, domination of the conscious over emotion and unconsciousness. It is right that the French navy is now to make it obligatory for its sailors to learn to swim.

From here we easily move on to much more philosophical problems.

I don't know whether you have paid attention to what my friend Marcel Granet has already pointed out in his great investigations into the techniques of Taoism, its body techniques, and breathing techniques in particular.[21] I have studied Sanskrit texts of Yoga enough to know that the same things occur in India. I believe precisely that at the bottom of all our mystical states there are body techniques that we have not studied, which were studied fully in China and India, even in very remote periods. This socio-psycho-biological study should be made. I think that there are necessarily biological means of entering into "communication with God." Although, in the end, breath technique and so on is only the basic aspect in India and China, I believe this technique is much more widespread. At any rate, on this point we have the methods to understand a great many facts that we have not understood hitherto. I even believe that all the recent discoveries in reflex therapy deserve our attention, ours, the sociologists', as well as that of biologists and psychologists... much more competent than ourselves.

Notes

1. Marcel Mauss, *Manuel d'ethnographie*, ed. Denise Paulme (Paris: Payot, 1947).

2. See Sydney Holland, "Swimming," *Encyclopaedia Britannica* (10th ed. [supp. to the 9th], Edinburgh: Encyclopaedia Britannica, 1902–1903), vol. 33, pp. 140–41 — TRANS.

3. Elsdon Best, *The Maori: Memoirs of the Polynesian Society*, 2 vols. (Wellington: Board of Maori Ethnological Research, 1924), vol. 1, p. 408 (cf. p. 135). [The latter reference seems to be a mistake of Mauss's; could he have been referring to vol. 1, p. 436, or vol. 2, p. 556, which refer to the gait of men and women respectively? — TRANS.]

a mistake of Mauss's; could he have been referring to vol. 1, p. 436, or vol. 2, p. 556, which refer to the gait of men and women respectively? — TRANS.]

4. Christian Gottlieb Teichelmann and Clamor Wilhelm Schurmann, *Outlines of a Grammar, Vocabulary, and Phraseology, of the Aboriginal Language of South Australia, Spoken by the Natives in and for Some Distance around Adelaide* (Adelaide: published by the authors at the native location), xerographic facsimile, South Australian Facsimile Editions no. 39, 1962, p. 73; quoted in Edward John Eyre, *Journals of Expeditions of Discovery into Central Australia and Overland from Adelaide to King George's Sound in the Years 1840–41*, 2 vols. (London: T. and W. Boone, 1845), vol. 2, p. 241.

5. Robert Hertz, "La Prééminence de la main droite: Etude sur la polarité religieuse," *Revue philosophique de la France et de l'étranger* 68 (1909), pp. 553–80 [Hertz, "The Pre-eminence of the Right Hand: A Study in Religious Polarity," in *Death and the Right Hand*, trans. Rodney and Claudia Needham (London: Cohen and West, 1960), pp. 87–113, 155–60].

6. Even the latest editions of Hermann Heinrich Ploss, *Das Weib* (Bertel's editions, etc.) leave something to be desired on this question. [See Hermann Heinrich Ploss, *Das Weib in der Natur- und Völkerkunde, Anthropologische Studien*, 2 vols. (Leipzig: Grieben, 1884); Ploss and Max Bartels, *Das Weib in der Natur- und Völkerkunde*, 2 vols. (8th ed, Leipzig: Grieben, 1905); and Ploss, Max Bartels and Paul Bartels, *Woman: An Historical, Gynecological and Anthropological Compendium*, 3 vols., ed. and trans. Eric John Dingwall (London: Heinemann, 1935) — TRANS.]

7. Walter Edmund Roth, *Ethnological Studies among the North-West-Central Queensland Aborigines* (Brisbane: Government Printer, 1897), pp. 182–83; idem, "An Introductory Study of the Arts, Crafts, and Customs of the Guiana Indians," *Thirty-Eighth Annual Report of the Bureau of American Ethnology to the Smithsonian Institution, 1916–17* (Washington, D.C., 1924), pp. 693–96.

8. Observations are beginning to be published on this point.

9. Ploss's large collection of facts, supplemented by Bartels, is satisfactory on this point. [See Ploss, Bartels and Bartels, *Woman*, vol. 3, p. 183 — TRANS.]

10. Fritz Graebner, *Ethnologie in die Kultur der Gegenwart*, ed. Paul Hinneberg (Leipzig: Teubner, 1923), pt. 3, sec. 5.

11. This is one of the useful observations in Graebner, *Ethnologie in die Kultur*.

12. Curt Sachs, *World History of the Dance*, trans. Bessie Schonberg (London: Allen and Unwin, 1935).

13. Curt Sachs uses the term "close dance" and "expanded dance" — TRANS.

14. Sachs, *World History of the Dance*, pp. 54–61.

15. I have just seen it in use at last (spring 1935).

16. Louis de Rougemont [pseudonym for Henri-Louis Grin], *The Adventures of Louis de Rougemont as Told by Himself* (London: Newnes, 1899), p. 86.

17. Robert Sutherland Rattray, *Ashanti* (Oxford: Clarendon Press, 1923), pp. 62–63, figs. 8–12, 15–16.

18. Franz Reuleaux, *The Kinematics of Machinery: Outlines of a Theory of Machines* (London: Macmillan, 1876), p. 43: "The kinetic elements of a machine are employed singly, but always in pairs; or in other words…the machine cannot so well be said to consist of elements as of pairs of elements [*Elementenpaare*]. This particular manner of constitution forms a distinguishing characteristic of the machine."

19. W. J. McGee, "The Seri Indians," *Seventeenth Annual Report of the Bureau of American Ethnology to the Smithsonian Institute for the Year 1895–96* (Washington, D.C., 1898), p. 152. [In fact, the Seri live on the island of Tiburon and the adjacent mainland of Sonora Province, Mexico, on the Gulf of California — TRANS.]

20. Friedrich Saloman Krauss, ed. *Anthropophyteia: Jahrbücher für folkloristische Erhebungen und Forshungen zur Entwicklunggeschichte der Geschlechtlichen Morala* (Leipzig: Deutsche Verlagaktiengesellschaft, 1904–1909; Ethnologischer Verlag, 1910–1913).

21. Marcel Granet, *Chinese Civilization* (New York: Knopf, 1930).

Johann Cruyff, 1975.

Jakob Halip, 1937.

Ethology: Spinoza and Us

Gilles Deleuze

"Spinoza and us" — this phrase could mean many things, but among other things, it means "us in the middle of Spinoza." To try to perceive and to understand Spinoza by way of the middle. Generally one begins with the first principle of a philosopher. But what counts is also the third, the fourth or the fifth principle. Everyone knows the first principle of Spinoza: one substance for all the attributes. But we also know the third, fourth or fifth principle: one Nature for all bodies, one Nature for all individuals, a nature that is itself an individual varying in an infinite number of ways. What is involved is no longer the affirmation of a single substance, but rather the laying out of a *common plane of immanence* on which all bodies, all minds and all individuals are situated. This plane of immanence or consistency is a plan, but not in the sense of a mental design, a project, a program; it is a plan in the geometric sense: a section, an intersection, a diagram.[1] Thus, to be in the middle of Spinoza is to be on this model plane, or rather to install oneself on this plane — which implies a mode of living, a way of life. What is this plane and how does one construct it? For at the same it is fully a plane of immanence, and yet it has to be constructed if one is to live in a Spinozist manner.

How does Spinoza define a body? A body, of whatever kind, is defined by Spinoza in two simultaneous ways. In the first place, a body, however small it may be, is composed of an infinite number of particles; it is the relations of motion and rest, of speeds and slownesses between particles that define a body, the individuality of a body. Second, a body affects other bodies, or is affected by other bodies; it is this capacity for affecting and being affected that also defines a body in its individuality. These two propositions appear to be very simple; one is kinetic and the other dynamic. But if one truly installs oneself in the midst of these propositions, if one lives them, things are much more complicated and one finds that one is a Spinozist before having understood why.

Thus, the kinetic proposition tells us that a body is defined by relations of motion and rest, of slowness and speed between particles. That is, it is not defined by a form or by functions. Global form, specific form and organic functions depend on relations of speed and slowness. Even the development of a form, the course of development of a form, depends on these relations, and not the reverse. The important thing is to understand life, each living individuality, not as form or a development of form but as a complex relation between differential velocities, between deceleration and acceleration of particles. A composition of speeds and slownesses on a plane of immanence. In the same way, a musical form will depend on a complex relation between speeds and slownesses of sound particles. It is not just a matter of music but of how to live: it is by speed and slowness that one slips in among things, that one connects with something else. One never commences; one never has a tabula rasa; one slips in, enters in the middle; one takes up or lays down rhythms.

The second proposition concerning bodies refers us to the capacity for affecting and being affected. You will not define a body (or a mind) by its form, nor by its organs or functions, and neither will you define it as a substance or a subject. Every reader of Spinoza knows that for him bodies and minds are not substances or subjects, but modes. It is not enough, however, merely to think this theoretically. For, concretely, a mode is a complex relation of speed and slowness, in the body but also in thought, and it is a capacity for affecting and being affected, pertaining to the body or to thought. Concretely, if you define bodies and thoughts as capacities for affecting and being affected, many things change. You will define an animal or a human being not by its form, its organs and its functions and not as a subject either; you will define it by the affects of which it is capable. Affective capacity, with a maximum threshold and a minimum threshold, is a constant notion in Spinoza. Take any animal and make a list of affects, in any order. Children know how to do this: Little Hans, in the case reported by Freud, makes a list of affects of a draft horse pulling a cart in a city (to be proud, to have blinders, to go fast, to pull a heavy load, to collapse, to be whipped, to kick up a racket, and so on). For example, there are greater differences between a plow horse or a draft horse and a racehorse than between an ox and a plow horse. This is because the racehorse and the plow horse have neither the same affects nor the same capacity for being affected; the plow horse has affects in common, rather, with the ox.

It should be clear that the plane of immanence, the plane of Nature that distributes affects, does not make any distinction at all between things that might be called natural and things that might be called artificial. Artifice is fully a part of Nature, since each thing, on the immanent plane of Nature, is defined by the arrangements of motions and affects into which it enters, whether these arrangements are artificial or natural. Long after Spinoza, biologists and naturalists will try to describe animal worlds defined by affects and capacities for affecting and being affected. For example, Jakob von Uexküll will do this for the tick, an animal that sucks the blood of mammals. He will define this animal by three affects: the first has to do with light (climb to the top of a branch); the second is olfactive (let yourself fall onto the mammal that passes beneath the branch); and the third is thermal (seek the area without fur, the warmest spot). A world with only three affects, in the midst of all that goes on in the immense forest. An optimal threshold and a pessimal in the capacity for being affected: the gorged tick that will die, and the tick capable of fasting for a very long time.[2] Such studies as this, which define bodies, animals or humans by the affects they are capable of, founded what is today called *ethology*. The approach is no less valid for us, for human beings, than for animals, because no one knows ahead of time the affects one is capable of; it is a long affair of experimentation, requiring a lasting prudence, a Spinozan wisdom that implies the construction of a plane of immanence or consistency. Spinoza's ethics has nothing to do with a morality; he conceives it as an ethology, that is, a composition of fast and slow speeds, of capacities for affecting and being affected on this plane of immanence or consistency. That is why Spinoza calls out to us in the way that he does: you do not know beforehand what good or bad you are capable of; you do not know beforehand what a body or a mind can do, in a given encounter, a given arrangement, a given combination.

Ethology is first of all the study of the relations of speed and slowness, of the capacities for affecting and being affected that characterize each thing. For each thing these relations and capacities have an amplitude, thresholds (maximum and minimum) and variations or transformations that are peculiar to them. And they select, in the world or in Nature, that which corresponds to the thing; that is, they select what affects or is affected by the thing, what moves or is moved by it. For example, given an animal, what is this animal unaffected by in the infinite world? What does it react to positively or negatively? What are its nutriments and its poisons? What does it "take" in its world? Every point has its counterpoints: the plant and the rain, the spider and the fly. So an animal, a thing, is never separable from its relations with the world. The interior is only a selected exterior, and the exterior, a projected interior. The speed or slowness of metabolisms, perceptions, actions and reactions link together to constitute a particular individual in the world.

Further, there is also the way in which these relations of speed and slowness are realized according to circumstances, and the way in which these capacities for being affected are filled. For they always are, but in different ways, depending on whether the present affects threaten the thing (diminish its power, slow it down, reduce it to the minimum), or strengthen, accelerate and increase it: poison or food? — with all the complications, since a poison can be a food for part of the thing considered.

Lastly, ethology studies the compositions of relations or capacities between different things. This is another aspect of the matter, distinct from the preceding ones. Heretofore, it was only a question of knowing how a particular thing could decompose other things by giving them a relation that was consistent with one of its own or, on the contrary, how it risks being decomposed by other things. But now it is a question of knowing whether relations (and which ones?) can compound directly to form a new, more "extensive" relation, or whether capacities can compound directly to constitute a more "intensive" capacity or power. It is no longer a matter of utilizations or captures, but of sociabilities and communities. How do individuals enter into composition with one another in order to form a higher individual, ad infinitum? How can a being take another being into its world, while preserving or respecting the other's own relations and world? And in this regard, what are the different types of sociabilities, for example? What is the difference between the society of human beings and the community of rational beings?...Now, we are concerned not with a relation of point to counterpoint, nor with the selection of a world, but with a symphony of Nature, the composition of a world that is increasingly wide and intense. In what order and in what manner will the powers, speeds and slownesses be composed?

A plane of musical composition, a plane of Nature, insofar as the latter is the fullest and most intense Individual, with parts that vary in an infinity of ways. Uexküll, one of the main founders of ethology, is a Spinozist when first he defines the melodic lines or contrapuntal relations that correspond to each thing, and then describes a symphony as an immanent higher unity that takes on the breadth and fullness ("natural composition"). This musical composition comes into play throughout the *Ethics*, constituting it as one and the same Individual whose relations of speed and slowness do not cease to vary, successively and simultaneously. Successively: the different parts of the *Ethics* are assigned changing relative velocities, until the absolute velocity of thought is reached in the third kind of knowledge. And simultaneously: the propositions and the scholia do not proceed at the same pace, but compose two movements that intercross. The *Ethics*, a composition whose parts are all carried forward by the greatest velocity, in the fullest movement. In a very fine text, Lagneau spoke of this velocity and amplitude, which caused him to compare the *Ethics* to a musical work: a lightning "speed of thought," a "wide-ranging power," a "capacity for discerning in a single act the relationship of the greatest possible number of thoughts."[3]

In short, if we are Spinozists we will not define a thing by its form, nor by its organs and its functions, nor as a substance or a subject. Borrowing terms from the Middle Ages, or from geography, we will define it by *longitude* and *latitude*. A body can be anything; it can be an animal, a body of sounds, a mind or an idea; it can be a linguistic corpus, a social body, a collectivity. We call longitude of a body the set of relations of speed and slowness, of motion and rest, between particles that compose it from this point of view, that is, between *unformed elements*.[4] We call latitude the set of affects that occupy a body at each moment, that is, the intensive states of an *anonymous force* (force for existing, capacity for being affected). In this way we construct the map of a body. The longitudes and latitudes together constitute Nature, the plane of immanence or consistency, which is always variable and is constantly being altered, composed and recomposed, by individuals and collectivities.

There are two very contrary conceptions of the word "plan," or of the idea of a plan, even if these two conceptions blend into one another and we go from one to the other imperceptibly. Any organization that comes from above and refers to a transcendence, be it a hidden one, can be called a theological plan: a design in the mind of God, but also an evolution in the supposed depths of nature, or a society's organization of power. A plan of this type can be structural or genetic, and both at the same time. It always involves forms and their developments, subjects and their formations. Development of forms and formation of subjects: this is the basic feature of this first type of plan. Thus, it is a plan of organization or development. Whatever one may say, then, it will always be a plan of transcendence that directs forms as well as subjects, and that stays hidden, that is never given, that can only be divined, induced, inferred from what it gives. It always has an additional dimension; it always implies a dimension supplementary to the dimensions of the given.

On the contrary, a plane of immanence has no supplementary dimension; the process of composition must be apprehended for itself, through that which it gives, in that which it gives. It is a plan of composition, not a plan of organization or development. Perhaps colors are indicative of the first type of plan, while music, silence and sounds, belong to this one. There is no longer a form, but only relations of velocity between infinitesimal particles of an unformed material. There is no longer a subject, but only individuating affective states of an anonymous force. Here the plan is concerned only with motions and rests, with dynamic affective changes. It will be perceived with that which it makes perceptible to us, as we proceed. We do not live or think or write in the same way on both plans. For example, Goethe, and even Hegel in certain respects, have been considered Spinozists, but they are not really Spinozists, because they never ceased to link the plan to the organization of a Form and to the formation of a Subject. The Spinozists, rather, are Hölderlin, Kleist and Nietzsche, because they think in terms of speeds and slownesses, of frozen catatonias and accelerated movements, unformed elements, nonsubjectified affects.

Writers, poets, musicians, filmmakers — painters too, even chance readers — may find that they are Spinozists; indeed, such a thing is more likely for them than for professional philosophers. It is a matter of one's practical conception of the "plan." It is not that one may be a Spinozist without knowing it. Rather, there is a strange privilege that Spinoza enjoys, something that seems to have been accomplished by him and no one else. He is a philosopher who commands an extraordinary conceptual apparatus, one that is highly developed, systematic and scholarly; and yet he is the quintessential object of an immediate, unprepared encounter, such that a nonphilosopher, or even someone without any formal education, can receive a sudden illumination from him, a "flash." Then it is as if one discovers that one is a Spinozist; one arrives in the middle of Spinoza, one is sucked up, drawn into the system or the composition. When Nietzsche writes, "I am really amazed, really delighted... I hardly knew Spinoza: what brought me to him now was the guidance of instinct,"[5] he is not speaking only as a philosopher. A historian of philosophy as rigorous as Victor Delbos was struck by this dual role of Spinoza, as a very elaborate model, but also as a secret inner impulse.[6] There is a double reading of Spinoza: on the one hand, a systematic reading in pursuit of the general idea and the unity of the parts, but on the other hand and at the same time, the affective reading, without an idea of the whole, where one is carried along or set down, put in motion or at rest, shaken or calmed according to the velocity of this or that part. Who is a Spinozist? Sometimes, certainly, the individual who works "on" Spinoza, on Spinoza's concepts, provided this is done with enough gratitude and admiration. But also the individual who, without being a philosopher, receives from Spinoza an affect, a set of affects, a kinetic determination, an impulse, and makes Spinoza an encounter, a passion. What is unique about Spinoza is that he, the most philosophic of the philosophers (unlike Socrates himself, Spinoza requires only philosophy...), teaches the philosopher how to become a nonphilosopher. And it is Part Five — not at all the most difficult, but the quickest, having an infinite velocity — that the two are brought together, the philosopher and the nonphilosopher, as one and the same being. Hence, what an extraordinary composition this Part Five has; how extraordinary is the way in which the meeting of concept and affect occurs there, and the way in which this meeting is prepared, made necessary by the celestial and subterranean movements that together compose the preceding parts.

Many commentators have loved Spinoza sufficiently to invoke a Wind when speaking of him. And in fact no other comparison is adequate. But should we think of the great calm wind the philosopher Delbos speaks of? Or should we think of the whirlwind, the witch's wind spoken of by "the man from Kiev," a nonphilosopher par excellence, a poor Jew who bought the *Ethics* for a kopek and did not understand how everything fit together?[7] Both, since the *Ethics* includes both the continuous set of propositions, demonstrations and corollaries, as a grand movement of concepts, and the discontinuous sequence of scholia, as a launching of affects and impulses, a series of whirlwinds. Part Five is the extreme extensive unity, but this is because it is also the most concentrated intensive peak: there is no longer any difference between the concept and life. But in the preceding parts there was already the composition or interweaving of the two components — what Romain Rolland called "the white sun of substance" and "the fiery words of Spinoza."

Notes

1. The French word *plan*, used by the author throughout this essay, covers virtually all the meanings of the English "plan" and "plane." To preserve the major contrast that Deleuze sets up here, between *plan d'immanence ou de consistance* and *plan de transcendance ou d'organisation*, I use "plane" for the first term, where the meaning is, roughly, a conceptual-affective continuum, and "plan" for the second term. The reader should also keep in mind that "plan" has the meaning of "map" in English as well. — TRANS.

2. Jakob von Uexküll, *Mondes animaux et monde humain* (Gonthier).

3. Jules Lagneau, *Célèbres leçons et fragments*, (2d ed., Paris: P.U.F., 1964), pp. 67–68. This is one of the great texts on Spinoza. Similarly, Romain Rolland, when he speaks of the velocity of thought and the musical order in Spinoza: *Empédocle d'Agrigente, suivi de l'Eclair de Spinoza* (Editions du Sablier, 1931). As a matter of fact, the theme of a velocity of thought greater than any given velocity can be found in Empedocles, Democritus or Epicurus.

4. See what Spinoza calls "the simplest bodies." They have neither number nor form nor figure, but are infinitely small and always exist as infinities. The only bodies having a form are the composite bodies, to which the simple bodies belong according to a particular relation.

5. See Nietzsche, letter to Overbeck, July 30, 1881.

6. Delbos, *Le Problème moral dans la philosophie de Spinoza et dans l'histoire du spinozisme* (Paris: Alcan). This is a much more important book than the academic work by the same author, *Le Spinozisme* (Paris: Vrin).

7. "Let me ask you what brought you to Spinoza? Is it that he was a Jew?"

"No, your honor. I didn't know who or what he was when I first came across the book — they don't exactly love him in the synagogue, if you've read the story of his life. I found it in a junkyard in a nearby town, paid a kopek and left cursing myself for wasting money hard to come by. Later I read through a few pages and kept on going as though there were a whirlwind at my back. As I say, I didn't understand every word, but when you're dealing with such ideas you feel as though you were taking a witch's ride. After that I wasn't the same man..."

"Would you mind explaining what you think Spinoza's work means? In other words, if it's a philosophy, what does it state?"

"That's not easy to say.... The book means different things according to the subject of the chapters, though it's all united underneath. But what I think it means is that he was out to make a free man of himself — as much as one can according to his philosophy, if you understand my meaning — by thinking things through and connecting everything up, if you'll go along with that, your honor."

"That isn't a bad approach, through the man rather than the work. But...."

From Bernard Malamud, *The Fixer*, 1966.

Translated from the French by Robert Hurley

The Influencing Machine [1919]

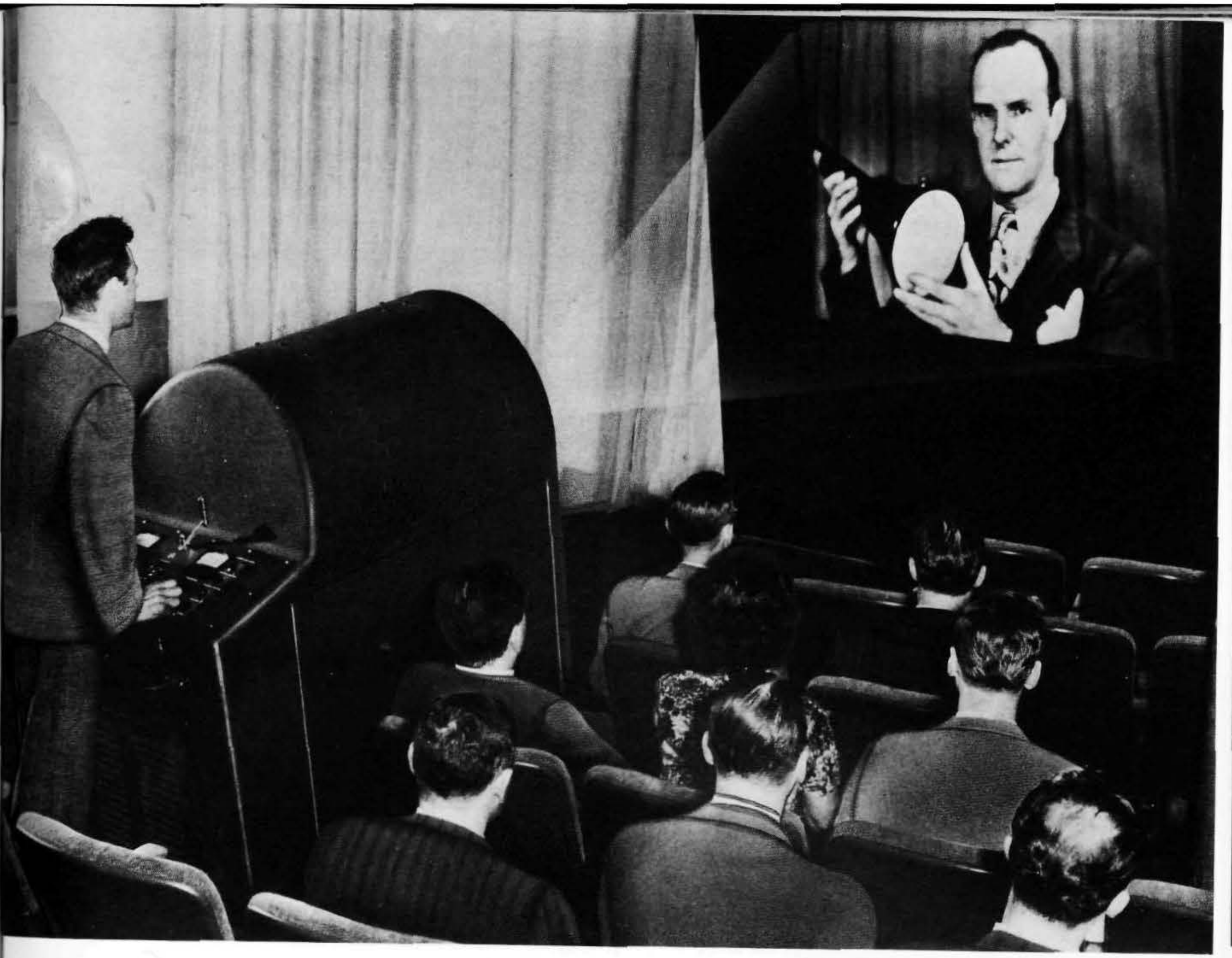
Victor Tausk

I

Methodological Observations. The following considerations are based on a single example of the Influencing Machine complained of by a certain type of schizophrenic patient. Although in this particular case the structure of the machine differs materially, to the best of my knowledge, from all other varieties of apparatus of this sort, it is hoped that the present example will nevertheless facilitate psychoanalytic insight into the genesis and purpose of this delusional instrument.

My example is a variant — a very rare variant — of the typical influencing machine. The objection can, of course, be made that it is rash to draw general conclusions from the study of a single case; and further, that generalizations to be regarded as scientifically valid should be based on a larger mass of material. My justification is that I have simply not encountered any further case material in support of my conclusions, and that, to the best of my knowledge, psychiatric literature contains no descriptions of individual cases of the influencing machine phenomenon, such as would make my paper superfluous. There exist only general descriptions of the apparatus, and its regular features and functions are given only as perfunctory, clinical illustrations. Clinical psychiatry, interested only in general descriptions, lays no stress on the significance of individual symptoms for the study of the dynamics of psychoses. Psychiatry has not hitherto sufficiently investigated the origin, the meaning and the purpose of a symptom because, not employing the psychoanalytical method, it does not even postulate such problems. Yet, in principle, it is permissible to derive general conclusions from exceptional types. Variants and mixed forms stimulate inquiry into general types. The conformity of typical cases may have the ultimate effect of an impenetrable barrier, while a deviation from type, on the other hand, may be a window in the wall through which a clear view is to be obtained.

Deviations from the rule and ambiguous types compel the assumption that a given phenomenon may be of diverse origin. It is only when an unexpected departure from the accustomed occurs that one feels the necessity of investigating the uniformity that had previously characterized the phenomenon or, at least, had seemed to do so. Inquiry into extraordinary causative factors has often stimulated inquiry into those ordinarily encountered.



It is to be hoped only that the example taken as a basis for the following conclusions will prove to justify them, and that the origin and significance of this variant example have been correctly conceived and formulated.

II

The schizophrenic influencing machine is a machine of mystical nature. The patients are able to give only vague hints of its construction. It consists of boxes, cranks, levers, wheels, buttons, wires, batteries and the like. Patients endeavor to discover the construction of the apparatus by means of their own technical knowledge, and it appears that with the progressive popularization of the sciences, all the forces known to technology are utilized to explain the functioning of the apparatus. All the discoveries of mankind, however, are regarded as inadequate to explain the marvelous powers of this machine, by which the patients feel themselves persecuted.

The Patients' Complaints Understood as "Effects" of the Influencing Machine. The main effects of the influencing machine are the following:

First: It makes the patients see pictures. When this is the case, the machine is generally a magic lantern or cinematograph. The pictures are seen on a single plane, on walls or windowpanes; unlike typical visual hallucinations, they are not three-dimensional.

Second: It produces, as well as removes, thoughts and feelings by means of waves or rays or mysterious forces, which the patient's knowledge of physics is inadequate to explain. In such cases, the machine is often called a "suggestion apparatus." Its construction cannot be explained, but its function consists in the transmission or "draining off" of thoughts and feelings by one or several persecutors.

Third: It produces motor phenomena in the body — erections and seminal emissions — that are intended to deprive the patient of his male potency and weaken him. This is accomplished either by means of suggestion or by air currents, electricity, magnetism or X-rays.

Fourth: It creates sensations that, in part, cannot be described, because they are strange to the patient himself, and that, in part, are sensed as electrical, magnetic or due to air currents.

Fifth: It is also responsible for other occurrences in the patient's body, such as cutaneous eruptions, abscesses and other pathological processes.

The machine serves to persecute the patient and is operated by enemies. To the best of my knowledge, the latter are exclusively of the male sex. They are predominantly physicians by whom the patient has been treated. The manipulation of the apparatus is likewise obscure, the patient rarely having a clear idea of its operation. Buttons are pushed, levers set in motion, cranks turned. The connection with the patient is often established by means of invisible wires leading into his bed, in which case the patient is influenced by the machine only when he is in bed.

The Same Complaints without Influencing Machine. However, it is noteworthy that a large number of patients complain of all these ailments without ascribing them to the influence of a machine. Many patients consider the cause of all these alien or hostile sensations, of physical or psychic change, to be simply an external mental influence, suggestion or telepathic power, emanating from enemies. My own observations and those of other authors leave no room for doubt that these complaints precede the symptom of the influencing apparatus, and that the latter is a subsequent pathological development. Its appearance, as many observers state, serves the purpose of an explanation for the pathological changes that are felt as alien and painful, which dominate the patient's emotional life and sensations.

According to this view, the idea of the influencing machine originates in the need for causality inherent in man; and the same need for causality will probably also account for the persecutors who act not through the medium of an apparatus but merely by suggestion or telepathy. Clinical psychiatry explains the symptom of an influencing machine as analogous to the ideas of persecution in paranoia (which, it is known, the patient invents in order to justify his delusions of grandeur), and calls it "*paranoia somatica*."

However, there is a group of patients that dispenses completely with any gratification of the need for causality, and complains simply of emotional changes and strange apparitions within the physical and psychic personality, without the intervention of foreign or hostile power. It is particularly declared by some patients that their visions are not foisted upon them in any way but that, to their great astonishment, they simply see them. There also occur other strange sensations for which there is no evidence of an originator — especially, for instance, the complaint of a loss or change of thoughts and feelings, without the thoughts or feelings being "drained" from them or foisted upon them. Complaints of a change of sensations in the skin, face and extremities are of a similar nature. This group of patients does not complain of influences originating from a foreign, hostile force, but of a feeling of inner estrangement. They become strange to themselves, no longer understand themselves: limbs, face, facial expression, thoughts and feelings have become estranged. These symptoms are clearly part of an early stage of *dementia praecox*, although they may also be observed in advanced stages.

Influencing Machine Terminal in a Symptomatology, Beginning with Feelings of Alienation. In some cases, it may be stated with certainty, and in others with strong probability, that the sense of persecution originates from the sensations of change accompanied by a sense of estrangement. These feelings of persecution are ascribed to a foreign, personal interference, suggestion, or telepathic influence. In other cases, the ideas of persecution or influence may be seen entering into the construction of an influencing apparatus. It is necessary to assume, therefore, that the influencing apparatus represents the terminal stage in the evolution of the symptom, which started with simple sensations of change. I do not believe that heretofore the entire sequence in the development of the symptom could have been studied completely from a single case; but I have observed the connection between at least two stages (of which I shall present an example later), and I have no hesitation in maintaining that under especially favorable circumstances it may be possible to observe the entire series of developmental stages in a single patient. Meanwhile, I am in the position of the observer of plasmodia who notes various pathological forms in the blood cells as developmental stages of a continuous cycle of growth, although he is never able to observe, in any one blood corpuscle, more than a single phase.

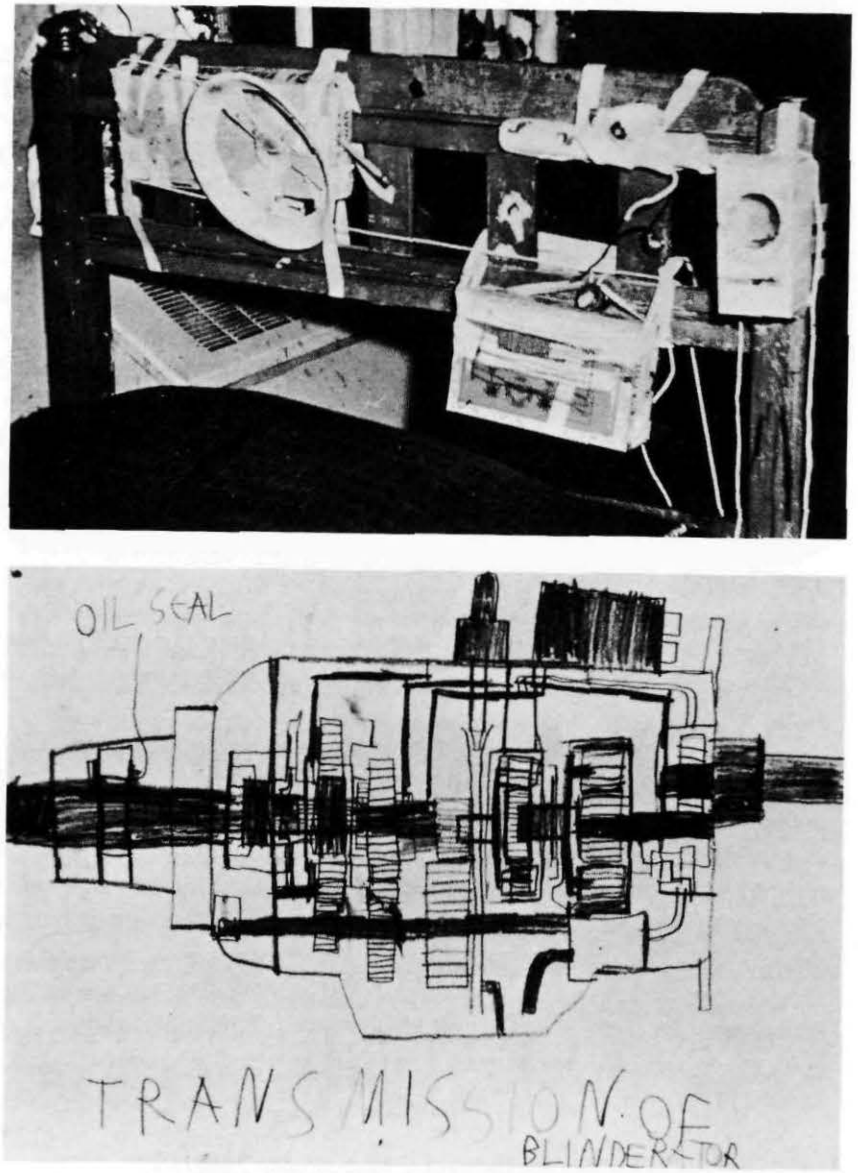
Recognition of the various symptoms as stages of a unified developmental process is rendered difficult not merely by inaccurate observation but by other factors as well. Patients conceal single stages behind secondary and correlative symptoms — each patient in accordance with his morbid disposition. Changes of feeling are covered up by a simultaneously or consecutively produced psychosis or neurosis belonging to another clinical group, such as depression, mania, paranoia, compulsion neurosis, anxiety hysteria or amentia. These clinical pictures, advancing to the foreground, conceal from the observer the more subtle elements in the development of the delusion of reference. It is very likely, moreover, that in many cases not every stage of development reaches consciousness, and that one stage or another runs its course in the unconscious and thus leaves gaps in the conscious psyche. Finally, depending on the rapidity of the pathological process and on the individual disposition, some of the stages may be missing altogether.

Ideas of reference in schizophrenia develop equally with or without the influencing apparatus. In but one case[1] have I been able to observe electrical currents in the absence of the influencing apparatus to which those are usually ascribed — in the absence, in fact, of any hostile powers whatsoever.

Discussion of Cases. The above observation was made in the case of a thirty-four-year-old man, Josef H., an inmate of insane asylums at frequent intervals throughout his life. He felt electrical currents streaming through him, which entered the earth through his legs; he produced the current within himself, declaring with pride that that was his power! How and for what purpose he did this he refused to disclose. On discovering these currents in himself for the first time, he was (he admitted) somewhat astonished, but he soon came to the conclusion that this manifestation had a special significance — that the currents served a mysterious end, regarding which he refused to give any information.

I shall now cite another instance, a singular case of *paranoia somatica*, having, as will later be seen, a significance of its own in substantiating the developmental process that I have assumed. The same example has already been cited by Freud in another connection. Miss Emma A. felt herself influenced by her lover in a singular manner: she maintained that her eyes were no longer properly placed in her head but were entirely twisted out of position, and this she attributed to the fact that her lover was an evil, deceitful person who twisted eyes. At church one day, she suddenly felt a thrust, as if she were being displaced; this was caused by the fact that her lover disguised himself,[2] and that he had already ruined her and made her as evil as himself.

This patient did not merely feel herself persecuted and influenced; hers was a case of being influenced by identification with the persecutor. If we take into consideration the view held by Freud and myself — that in object-choice the mechanism of identification precedes the cathexis proper by projection — we may regard the case of Miss Emma A. as representing the stage in the development of the delusion of reference preceding the projection (namely, onto a distant persecutor in the outer world). The identification is obviously an attempt to project the feelings of the



Joey, the "mechanical" boy was an autistic child successfully treated by Dr. Bruno Bettelheim at the University of Chicago Orthogenic School. Fluent in machinic terminology, Joey constructed a series of elaborate and fantastic electrical machines that, for a period, mediated all human contact and daily activity including eating, sleeping and defecation.

Pictured above is the car machine which drove Joey during sleep. This battery powered machine, included a speaker which allowed him to talk and to hear. Shown in one of Joey's drawings is the machine that ran him by remote control. Note the "oilseal" that protected him from total disembowelment, and the "Transmission of Blinderator" which prevented seeing and understanding.

inner change onto the outer world. It constitutes a bridge between the feelings of an inner change without external cause and the attribution of these changes to the power of an external person — a kind of intermediary position between the feeling of self-estrangement and the delusion of reference. This rounds out especially well, and substantiates psychoanalytically, the concept of the development of the symptom, up to its crystallization in the influencing machine. We are here concerned with the discovery, or rather the invention, of a hostile object; for the intellectual process, though, it is unimportant whether the objects observed are hostile or friendly, and the psychoanalyst, at least, *will certainly have no objection to the equating of love and hate in this* instance. Among the illustrations that may be given of the various forms or stages of the delusion of reference, the case of Staudenmayer (whose autobiography was presented before the Vienna Psychoanalytic Society some years ago) may be mentioned.

Staudenmayer — who, if I am not mistaken, was declared to be a paranoiac and is at any rate considered to be one by me — described his sensations during his bowel movements from the beginning of the movement to its conclusion, and attributed every single peristaltic motion coming to his awareness to the activity of special demons allegedly located in the intestines and entrusted with the performance of each separate motion.

The Complete Symptomatology. We may now summarize and describe schematically the phenomena that, in some cases, appear to be produced by the influencing machine and, in other cases, occur without it.

First: We note simple sensations of inner change in the beginning devoid of, and later accompanied by, a sense of estrangement, without awareness of an originator. The sensations are of changes in the psychic and physical functions within various parts of one's own body. In many cases, this stage of the illness probably occurs at a very early age, before puberty. Because at this age no exact reports can be obtained on inner conditions, and because, moreover, pathological changes are not infrequently compensated by infantile peculiarities of character (such as naughtiness, aggressiveness, concealed fantasies, masturbation, seclusiveness, dullness and so forth), this stage either remains unrecognized or else is misnamed. It is only at puberty, when special adjustments to the environment are required of the individual, who is compelled to relinquish all crude expressions of his abnormality, that the illness comes to the surface; it is at this time, too, that further development of symptoms is stimulated.

Second: Feelings of inner change in the form of abnormal sensations, with awareness of an originator — in this instance the patient himself (case Josef H.).

Third: Feelings of inner change accompanied by awareness of an originator, who, although existing within the patient, is nevertheless not the patient himself (case Staudenmayer).

Fourth: Feelings of inner change accompanied by hallucinatory projection of the inner occurrence to the external world, without awareness of an originator; at first, feelings of estrangement are not present, but later on they appear (seeing pictures).

Fifth: Feelings of inner change accompanied by awareness of an external originator as a result of identification (case Emma A.).

Sixth: Feelings of inner change accompanied by projection of the inner occurrence onto the outer world and belief in an originator produced by the paranoid mechanism (causing pictures to appear, influencing by suggestion, hypnotism, electricity, producing or draining off thoughts and feelings, effecting bodily motions, weakening potency, producing erections, seminal emissions and so forth).

Seventh: Feelings of inner change attributed to the workings of the influencing machine manipulated by enemies. At first, the enemies are usually unknown to the patient and only vaguely discerned by him; later on, he is able to make them out, knows who they are and enlarges their circle after the pattern of the paranoid conspiracy. Similarly, the patient is at first completely unable to explain the construction of the influencing apparatus, but he familiarizes himself with it gradually.

Having solved the relation between ideas of reference and the influencing apparatus, we may proceed to an examination of the latter without reference to its effects.

The Construction of the Influencing Machine. It is not necessary to discuss the magic lantern that produces pictures or images, because its structure harmonizes perfectly with the function attributed to it, and because it does not reveal any error of judgment beyond the fact of its nonexistence. This rational superstructure is absolutely impenetrable. We must, at the start, use structures less solidly built, the walls of which reveal gaps through which it is possible to look inside.

The ordinary influencing machine has a very obscure construction; large parts of it are completely unimaginable. In cases where the patient believes he understands the construction of the apparatus well, it is obvious that this feeling is, at best, analogous to that of a dreamer who has a feeling of understanding, but has not the understanding itself. This characteristic may be discovered whenever an accurate description of the apparatus is demanded of the patient.

Also, the apparatus is, as far as I know, always a machine — a very complicated one.

The "Machine" — A Symbol of Individual's Genitals (cf. Dreams of Machines). The psychoanalyst cannot for a moment doubt that this machine must be a symbol — a view recently emphasized by Freud in one of his lectures, in which he stated that the complicated machines appearing in dreams always represent the genitalia. Having studied machine dreams analytically over a long period of time, I can fully confirm Freud's statement; I may add, moreover, that the machines always stand for the dreamer's own genitalia and that the dreams are of a masturbatory character. I can state further that these dreams are dreams of escape, of the type described in my paper on alcoholic delirium.[3] In this paper it is shown that whenever an urge to masturbate, or rather a readiness to ejaculate semen, leads to a dream fantasy that is favorable to discharge, another fantasy is hastily substituted, by means of which a new state of inhibition is induced momentarily, and the ejaculation of semen is made difficult, if not impossible. The dream reacts to the repudiated wish for discharge with a successive alteration of symbols.

The machine dream possesses an analogous mechanism, except that the introduction of single components of the machine is not accompanied by the simultaneous disappearance of the other components for which they are substituted — the new components are simply added to the old ones. This is how the hopelessly complex machine originates. In order to strengthen the inhibition, the symbol has been made complex, instead of being displaced by another one; but the result is the same. Each complexity draws the attention of the dreamer to himself, rouses his intellectual interest, reciprocally weakens his libidinal interest and effects in this manner inhibition of instinct.

In machine dreams, the dreamer awakens, more often than not, with his hand on his genitalia, after having dreamed of manipulating the machine. It may, therefore, be assumed that the influencing apparatus is a representation of the patient's genitalia projected onto the outer world, analogous in origin to the machine in dreams. The frequent complaint of the schizophrenic that the apparatus causes erection, drains off semen and weakens potency only confirms this view. At any rate, the analogy of the symptom to a dream production, as well as the accessibility of the symptom to psychoanalytic dream interpretation, is a step beyond the rationalizations and the demand for causal connections that underlie the usual clinical interpretation of the influencing machine in schizophrenia. I can now present my example, which will not only strengthen my hypothesis, but will enlarge it materially.

The Case of Natalija A.: Report. The patient is Miss Natalija A., thirty-one years old, a former student of philosophy. She has been completely deaf for a great number of years, due to an ulcer of the ear, and can make herself understood only by means of writing. She declares that for six and a half years she has been under the influence of an electrical machine made in Berlin, though this machine's use is prohibited by the police. It has the form of a human body, indeed, the patient's own form, though not in all details. Her mother, like her male and female friends, is also under the influence of this machine or similar machines. Of the latter she gives no explanation, describing only the apparatus to which she herself is subjected. She is certain that for men there is a masculine machine representing the masculine form and for women a female one. The trunk (torso) has the shape of a lid, resembling the lid of a coffin, and is lined with silk or velvet. Regarding the limbs, two significant explanations are given. At the first interview, she described them as entirely natural parts of the body. A few weeks later, these limbs were not placed on the coffin lid in their natural form, but were merely drawn on it in two dimensions, in the position they would occupy in the natural state of the body. She cannot see the head — she says that she is not sure about it and does not know whether the machine bears her own head. She has practically nothing to report about the head. The patient does not know definitely how this machine is to be handled, or how it is connected with her; but she vaguely thinks that it is by means of telepathy. The outstanding fact about the machine is that it is being manipulated by someone in a certain manner, and everything that occurs to it happens also to her. When someone strikes this machine, she feels the blow in the corresponding part of her body. The ulcer (lupus) now present on her nose was first produced on the nose of the machine, and some time later the patient herself became afflicted with it. The inner parts of the machine consist of electric batteries, which are supposed to represent the internal organs of the human body. Those who handle the machine produce a slimy substance in her nose, disgusting smells, dreams, thoughts, feelings, and they also disturb her while she is thinking, reading or writing. At an earlier stage, sexual sensations were produced in her through manipulation of the genitalia of the machine; but now the machine no longer possesses any genitalia, though why or how they disappeared she cannot tell. Ever since the machine lost its genitalia, the patient has ceased to experience sexual sensations.

She became familiar with the apparatus — about which she had previously heard — through all kinds of occurrences, especially through conversations among people, that is, through auditory hallucinations. The man who utilizes the apparatus to persecute her, her rejected suitor, a college professor, is prompted by jealousy. Very soon after she had refused his courtship she felt that he was trying, by means of suggestion, to bring about a friendship between his sister-in-law, her mother and herself — his obvious purpose being to use this influence to make her accept him. When, however, suggestion failed, he subjected her to the influence of the machine; not only the patient herself but also her mother, her physicians, her friends and all those who had her welfare at heart, came under the influence of this diabolical apparatus, with the result that the physicians submitted a mistaken diagnosis to her: the apparatus deluded them into diagnosing ailments other than those with which she was afflicted. She could no longer get along with her friends and relatives: she aroused everyone's animosity and felt compelled to run away. It was impossible to obtain any further details from the patient. On her third visit, she became inaccessible and only stated that the analyst, too, was under the influence of the apparatus, that he had become hostile to her and that they could no longer understand each other.

The Case of Natalija A.: Interpretation. This case provides a definite reason for believing that the influencing machine represents a stage in the development of a symptom that can also appear without this stage, as a delusion of reference. The patient clearly stated that her persecutor had recourse to the apparatus only when his attempt to influence her by suggestion failed. The fact that she seems to have previously heard about the machine is also enlightening. This vague recognition obviously awakened in the patient old familiar sensations that she had experienced before she was subjected to the apparatus; this is analogous to the well-known fact that persons in a state of infatuation have the feeling of having always known the beloved one — though in reality, they are merely rediscovering one of their old libidinal imagos. We shall later hear just how remote was the past in which she had first experienced sensations similar to those caused by the influencing apparatus.

The peculiar construction of the machine substantiates my assumptions to a great extent, especially with regard to the significance of the machine as a projected symbol of the genitalia. I may add that the apparatus represents not only the patient's genitalia but, obviously, her whole person. It represents the projection of the patient's body onto the outer world. At least the following results are unquestionably obtained from the patient's report: the apparatus is distinguished above all by its human form, easily recognized despite many nonhuman characteristics. In form, it resembles the patient herself, and she senses all manipulations performed on the apparatus in the corresponding part of her own body and in the same manner. All effects and changes undergone by the apparatus take place simultaneously in the patient's body, and vice versa. Thus, the apparatus loses its genitalia following the patient's loss of her genital sensations;

it had possessed genitalia for as long a period as her genital sensations had lasted.

Applying the technique of dream interpretation to this case, it may be said that the patient's inability to provide any detailed description of the head of the apparatus, and especially her inability to decide whether it was her own head or not, proves conclusively that it is her own head. We know from analytic observations that the person not recognized in a dream is actually the dreamer himself. In my analysis of the *Dream of the Clinic*,[4] it was clear that the dreamer meant herself when she dreamed of a person whose head she could not see.

A further detail in the description of the apparatus — namely, that the lid is lined with silk or velvet — may substantiate this opinion. Women very frequently describe the feelings evoked by caressing their own skin in such terms. That the intestines appear in the form of batteries is only of slight significance here, although it will assume a more profound meaning later on. This superficial interpretation may be associated with the information given directly or indirectly to schoolchildren, to the effect that the viscera resemble a very complicated machine. In this case, the tendency seems to be toward a verbal interpretation of this infantile conception. This conclusion, regarding its ontogeny, is arrived at with the help of the patient's description of her influencing apparatus.

Initially, the patient reported that the limbs of the apparatus appeared in their natural form and position. Several weeks later, she declared that the limbs were drawn on the lid. This is obviously a manifestation of the progressive distortion undergone by the apparatus, which, consequently, eventually loses all human characteristics and becomes a typical, unintelligible influencing machine. First the genitalia, then the limbs are eliminated in this process. The patient, to be sure, is unable to report how the genitalia are removed. She states, however, that the limbs are removed in the following manner: they lose their three-dimensional human form, flattening to a two-dimensional plane. It would not have been surprising if, after a lapse of several weeks, the patient had declared that the apparatus did not possess any limbs at all. Nor would it have been astonishing had she stated that the apparatus had never had any limbs. A failure to recall the developmental stages of the apparatus has obviously the same significance as that of forgetting the origins of dream pictures. It is not too bold to draw the conclusion that the coffin lid of the machine is a product of such successive distortions, and that originally it had represented a human being — namely, the patient herself.

Psychoanalytic experience brings to light the causative factors in such distortion. Underlying every distortion of a psychic phenomenon there is a defense mechanism that has as its aim the protection of the conscious ego against the appearance or reappearance of undisguised fantasies. The patient obviously seeks not to recognize herself in the influencing machine, and thus, in self-protection, she divests it of all human features; in short, the less human the appearance of the delusion, the less does she recognize herself in it. The origin of this rejection will be examined later.

When the influencing machine of Miss Natalija A. first came to my attention, it was in a special stage of development; I was fortunate, moreover, in observing the machine in the process of development as concerned the limbs, and also in obtaining specific information from the patient herself regarding the genitalia. I assume that this process will end with the production of the typical influencing apparatus known to clinical observation, but I cannot affirm that this apparatus will pass through all the stages of development to the very end. It is very possible that it will stop at a middle point, without proceeding further.

III

In the meantime, I shall consider a second hypothesis that may have suggested itself to the reader. It must be taken into consideration that, notwithstanding all that has been said above, the influencing machine of Miss Natalija A. may be merely an inexplicable exception to the general rule. The complex, unintelligible machine, as fantastically described and interpreted by other patients, would perhaps first have to be studied and defined before an explanation of Miss Natalija A.'s influencing machine could be undertaken. For want of other material at hand to substantiate my hypothesis, except the machine dream, I shall start with the assumption that the influencing apparatus is a projection of the patient's genitalia. In presenting this second hypothesis together with, or in lieu of, the first, I realize how much indulgence is exacted from the reader, and I should not be surprised if I were reproached with levity or legerdemain. I myself was unpleasantly surprised to discover that this second hypothesis was probably as valid as the first, and that consequently both became improbable or worthless, for their content differs and each leads to quite a different theory. Fortunately, another theory suggests itself, one that brings into immediate harmony both interpretations of the influencing apparatus. This problem will be touched on again toward the end of this paper.

Regressive Loss of Ego Boundaries. Attention may be called now to a symptom in schizophrenia, which I have named "loss of ego boundaries." This symptom is the complaint that "everyone" knows the patient's thoughts, that his thoughts are not enclosed in his own head, but are spread throughout the world and occur simultaneously in the heads of all persons. The patient seems no longer to realize that he is a separate psychic entity, an ego with individual boundaries. A sixteen-year-old patient in the Wagner-Jauregg Clinic indulged in gay laughter whenever she was asked for her thoughts. Catamnesis revealed that for a long while when being questioned, she believed I had been jesting; she knew that I must be familiar with her thoughts, because they occurred at the same time in my own head.

We are familiar with this infantile stage of thinking, in which a strong belief exists that others know of the child's thoughts. Until the child has been successful in its first lie, the parents are supposed to know everything, even its most secret thoughts. Later on, in the event that the child has been caught lying, this conception may be formed again, now caused by the feeling of guilt. The striving for the right to have secrets from which the parents are excluded is one of the most powerful factors in the formation of the ego, especially in establishing and carrying out one's own will. The developmental stage observed in the above-mentioned case falls into this period when the child does not yet sense this right to privacy and does not yet doubt that the parents and educators know everything.[5]

Patients deduce subsequently from their own thoughts the symptom whose content is that "thoughts are given to them." This must be attributed to the infantile impression originating in an earlier period in life, when the child knows nothing through its own efforts but, rather, obtains all its knowledge from others: how to make use of its limbs, its language, its thoughts. In that period, all is "given to" the child, all joy and all sorrow, and it is difficult to evaluate what share the child itself has in its accomplishments.[6] The sudden discovery that it is able to accomplish a task without the help of others is greeted by the child with a great deal of surprise and excitement. It is *probable, therefore, that this symptom represents a regression to this particular stage of infancy.* This special period of infancy, though, presents a problem: How far back does it go? What causes the formation of the ego and, as a reaction to the outer world, the ego boundaries? What arouses the realization of individuality, of self, as a distinct psychic unit?

Theoretically, we cannot assume that the ego begins to take form earlier than the time of object finding. The latter comes with gratification and renunciation of instinctual drives, whereas an awareness of the outer world, independent of the infant's drives and desires, is established only gradually. It is hardly possible that the sex instincts should have a greater influence on the development of this awareness than the drive to be nourished. To be sure, the sex instincts will soon take on a special significance that must not be underestimated. But, for the time being, it should be stated that there is a stage when no objects of the outer world exist, and therefore there is no realization that one has an ego.

In that period there exist, nevertheless, desires and drives, and a specific urge to obtain mastery *over whatever stimulates the sex organs is observable.*

Some Theoretical Speculations. The developmental stage that precedes the stage of object finding has been recognized as that of *identification*. This became evident from the analysis of neurotics, in whom the inability to obtain possession of objects of gratification, or to reach goals of pleasure, was seen to be due to their identification with the objects. The neurotic himself simply stands for what attracts him in the outer world; he has not found his way to the outer world and, therefore, is unable to develop an adequate ego in his stunted, exclusively libidinal relationships. This peculiar organization of libido has been termed "narcissistic." The libido in such cases has been directed toward the neurotic's own personality; it is attached to his own ego and not to the objects of the outer world. Observations and theoretical considerations, especially those of Freud, have led to the assumption that this libido organization characterizes the beginning of psychic development, the "objectless" period, and that this libido organization must be considered a correlate, if not a cause, of the "objectlessness." *This organization of libido corresponds also to the stage of intellectual* development in which the person considers all the sensory stimuli he receives as endogenous and immanent. At this stage of development the psyche does not yet perceive that intervals of time and space exist between the object from which the stimulus emanates and the sensory response.

The next stage of development is, then, that of an outward projection of the stimulus and the attributing of this stimulus to a distant object, hence a stage of distancing and objectification of the intellect, and along with this a transfer of libido to the discovered, or rather, self-created, outer world. As a safeguard to this psychic achievement, and as a kind of critical authority for objectification, there evolves at the same time the faculty of distinguishing between objectivity and subjectivity, an awareness of reality, which enables the individual to recognize his inner experiences as distinct from the outer stimuli — in other words, to regard inner experiences as internal and not to confuse them with the objects of sensory response.

This correlative developmental process, however, is apt to meet with inhibitions. There are inhibitions from the intellectual side, or as we say, from the ego — the chief weapon of which is the *intellect; and there are inhibitions that arise from the transference of libido in various stages of* development, and with various results, depending on the relation of the ego to the libido. These points of inhibition are called, after Freud, "fixation points." In most cases, the factor that causes ego disturbances seems to lie in lesions of the libido. Thus, it is clear from Freud's interpretation that paranoia is a reaction to repressed homosexuality. The prohibition against finding an object for the homosexual drive, which results in an inhibition of the transference of homosexual libido organization, should be recognized as originating from within and remaining within. This projection is a defensive measure of the ego against the renounced homosexual libido that emerges with onrushing force out of repression. Libidinal inhibition leads to intellectual inhibition, which may be manifested in impaired judgment or in insanity. An internal psychic process due to displacement and projection is mistaken for an external one, which leads to more or less marked "affective weakness of judgment," with the accompanying reactions of the psyche quantitatively and qualitatively determined by the morbid process.

One may say that in the case of impaired libido organization, the ego finds itself faced with the task of mastering an insane outer world, and hence behaves insanely.[7]

In the neuropsychoses that usually appear in later life, with a history of previous relative psychic health, it is not difficult to observe that the impairment of the ego is caused by an impairment of the libido. However, in cases of psychosis that develop gradually and insidiously, beginning with earliest infancy, we may assume not so much a successive impairment of libido and ego as a correlative inhibition, primarily, of the entire development of the individual. The one group of instinctual drives does not develop normally, and this is paralleled by an arrest of the functions of the other group of drives, and by a simultaneous development of secondary relations, which are to be regarded as attempts at self-cure and at adaptation to the functional disturbance by means of compensations and overcompensations. Furthermore, regressions occur on the part of functions that have developed normally but, whenever there is a marked discordance between the diseased and the normal portions of the psyche, abandon their normal level and retreat, for the purpose *of adaptation, to the lower level of the impaired functions.* During this retreat, there may arise various temporary or permanent symptom formations of different clinical types; and from these develop mixed psychotic formations. The existence of these partial processes, and their great variety with regard to levels of regression at a given moment, require careful consideration. In considering inhibitions of instinctual drives, one must constantly keep in mind that all inhibited drives are capable of being transformed into, or being discharged as, anxiety. To quote Freud, "It may be said that, in a certain theoretical sense, symptoms are formed only in order to forestall an otherwise inevitable development of anxiety."

IV

We have learned from Freud that the projection of the homosexual libido in paranoia is to be regarded as a defensive measure of the ego against an inopportune and socially reprehensible sexual urge pressing from the unconscious. Is it possible to regard the projection of the patient's own body in the case of Miss Natalija A. as an analogous situation? Naturally, the projection would have to subserve the defense of that libido which belongs to the patient's own body, and which has become either too extensive or too inopportune in its demands for the patient to be able to tolerate it as her own. It is also necessary to assume that this projection pertains only to the libido of the body and not to the libido of the psychic ego as well; that, moreover, the libido of the psychic ego[8] has facilitated the defense against the bodily libido because it was, so to speak, ashamed of it. That a projection mechanism has been chosen for the purpose of defense — a mechanism belonging to the primary functioning of the ego in the process of object finding — gives reason to believe that one is here dealing with a libido position that is coeval with the beginnings of intellectual object finding and achieved either by regression or by the persistence of a vestigial phenomenon (*Resterscheinung* — Freud), which has been for years, and up to the onset of the illness, effectively compensated or concealed. In regressions, however, there is always an effort to reach the formerly uninhibited libido positions. In paranoia, regression reaches a stage when homosexual object choice has not yet come under the prohibition of the ego and there is free homosexual libido, which is only later subjected to repression at the behest of the cultural demands of the ego.

The libido directed toward a person's own self, which the ego tries to get rid of by projecting its own body, is, naturally, characteristic of a period when it was still free from conflict with the demands of other love-objects. This period must coincide with the developmental stage of the psyche in which object finding still occurs within the individual's own body, and when the latter is still regarded as part of the outer world.

I am intentionally differentiating between object choice and object finding. By the former, I mean only libidinal cathexis; by the latter, the intellectual awarenesses of this cathexis. An object is found by the intellect, and *chosen* by the libido. These processes may occur either simultaneously or in sequence, but for my purpose they are to be regarded as distinct.

The projection of one's body may, then, be traced back to the developmental stage in which one's own body is the goal of the object finding. This must be the time when the infant is discovering his body, part by part, as the outer world, and is still groping for his hands and feet as though they were foreign objects. At this time, everything that "happens" to him emanates from his own body: his psyche is the object of stimuli arising in his own body but acting on it as if produced by outer objects. Later, these disjecta membra are pieced together and systematized into a unified whole under the supervision of a psychic unity that receives all sensations of pleasure and pain from these separate parts. This process takes place by means of identification with one's own body. The ego, thus discovered, is cathected with the available libido; in accordance with the psychic nature of the ego, narcissism develops; and in accordance with the function of individual organs as sources of pleasure, autoeroticism results.

But if the psychoanalytic theories previously employed are correct, this object finding within one's own organs, which can be regarded as parts of the outer world only by projection, must be preceded by a stage of identification with a narcissistic libido position,[9] and it is necessary to assume two successive stages of identification and projection.

The projection that participated in the object finding within one's own organs would, then, be the second phase of the preceding stage — although the part that depends on the postulated identification has yet to be discovered.

I am, then, assuming the existence of these two successive phases of identification and projection in object finding and object choice within one's own body.

I do not run counter to psychoanalytic conceptions in contending that the individual comes into the world as an organic unity in which libido and ego are not yet separated, and all available libido is related to that organic unity which does not deserve the name "ego" (that is, a psychic self-protective organization) any more than does the cell. In this situation, the individual is equally a sexual and an individual being, simultaneously performing ego and reproductive functions — like the cell that takes nourishment up to the time when it divides. This stage of the newly born child is biological up to the time of conception, but must be regarded as psychological from the time when — at an indeterminable stage of fetal life — cerebral development takes place. From the viewpoint of libido, we may say that the newly born child is a sexual being. I am in accord with Freud's assumption that the individual's first renunciation is the renunciation of the protection of the mother's body, imposed upon the libido and accompanied by that expression of anxiety, the birth cry. However, once this first trauma is over and no discontent arises to bring the infant into a clash with itself and with the environment, it is in complete possession of its own libido and knows nothing of the outer world, not even that part of the world it will soon discover within itself. This is the stage of identity that precedes the first projection for the purpose of object finding within one's own body. This stage did not come about because of that psychic activity which may be called "identification," but is present from the beginning. Nevertheless, the result is the same as in actively established identity — absolute self-satisfaction, no outer world, no objects. I shall designate this stage as "innate narcissistic" — a situation in which the libido, directed outward, first cathects the subject's own body by the indirect way of projection, and returns by way of self-discovery to the ego. In the meantime, the ego has undergone a decided alteration under the influence of these first psychic stirrings, which one may call "experience," and is now again cathected by libido. I shall call this stage "acquired narcissism"; it finds a considerable quantity of innate narcissism already present and is superimposed on it. The condition of innate narcissism normally remains attached for all time to the organs and their functions, and is in constant conflict with the various further stages of ego development, which, with the assistance of anxiety and judgment, take place under the aegis of all the faculties that have been gradually acquired in the meantime. The struggle is carried on, at first, chiefly in the spheres of excretory functions and of the autoerotic sources of pleasure, since these are the spheres that give rise to the greatest difficulties in the individual's relation to the environment. Nevertheless, we must definitely understand that throughout life the ego develops with constant shiftings in the narcissistic libido position —

that man, in his struggle for existence, is constantly compelled to find and recognize himself anew — *and that the acquisition of narcissism is immanent in culture and is conceivable only on* the basis of an intact inborn narcissism that serves as a source of nourishment and regeneration. This constant struggle revolving around the self occurs in various degrees in relation to various instinctual drives; it concerns homo- and heterosexuality and every libido component in different degrees at different times, and provokes various reactions, compensations, superstructures and eliminations. These secondary psychic formations then enter again into combination and produce insoluble dynamic, qualitative, relative and modal relations, resulting in a great variety of character types and symptoms. The development of both the ego and the libido — either alone or in their relation to each other — may become arrested and may set up goals of regression at as many points as there are primary, secondary, tertiary (and so on) factors of relationship and development.

Pathological Projection as a Defense against Narcissistic Regression of Libido. The entire problem is further complicated by the elements of time and space, and so made insoluble. Suppose that the projection of one's own body is a pathological repetition of that psychic stage when the individual was endeavoring to discover his body by means of projection. It would not be too much to say that just as the projection in normal primary development has been successful because the innate narcissistic libido position had to be renounced under the attack of outer stimuli, so also pathological projection takes place because there has developed an accumulation of narcissistic libido analogous to the primary narcissism — although here it is anachronistic, regressive or fixated, yet resembles it in character insofar as it isolates the individual from the outer world. Hence, projection of one's own body may be regarded as a defense against a libido position corresponding to the end of fetal existence and the beginning of extrauterine development. Freud, indeed, has not hesitated to declare, in his Introductory Lectures, that psychological problems are to be traced back to intrauterine existence.[10]

Explanation of Several Psychotic Phenomena on This Basis. These considerations may be used as a starting point for the explanation of various schizophrenic symptoms. Is it not possible that catalepsy (*flexibilitas cerea*) corresponds to the stage when man senses his own organs as foreign, as not belonging to himself, as being dominated by an outside force? A similar instance is the symptom of having one's limbs moved by someone. This symptom reproduces especially well the situation in which one's own body becomes strange and, so to speak, part of an outer world dominated by outer forces. May we not say that catatonic stupor, which represents a complete rejection of the outer world, is a return to the uterus? May not these severest catatonic symptoms be the ultimate refuge of a psyche that has given up even the most primitive ego functions and, in toto, has retreated to the fetal and nursing stages, because it cannot use in the present state of its libido even the simplest ego functions that maintain the relation to the outer world? The catatonic symptom, the negativistic stare of the schizophrenic, is nothing else than a renunciation of the outer world expressed in "organ language." Does not also the "nursing reflex" in the terminal stages of general paralysis indicate such a regression to infancy?[11]

The psychic correlate of *flexibilitas cerea* and that stage in which man regards himself as a part of the outer world, *lacks consciousness of his own volition and of his own ego boundaries*, is the patient's feeling that his thoughts are known and possessed by everyone else. In the period here duplicated pathologically, there are indeed no thoughts, but even thoughts are subjected, as already stated above, to the same process of being regarded at first as coming from the outer world before *they are counted among the functions of the ego. Thoughts must first be assimilated into the con*sciousness of ego unity before they can be an automatic ego function; and this cannot occur before the intellect has advanced to the stage of memory perceptions. Freud has taught that this, too, is a later process, preceded by the stage of hallucinations of memory pictures — that is, a stage when *the perceptions actually appear in the outer world and are not regarded as internal occurrences.* Moreover, this stage of hallucinatory perceptions, in itself representing a kind of objectification, object finding and object choice, also belongs to the first period of life. The regression, of course, does not occur equally in all psychic faculties and relationships. The capacity for thinking with memory perceptions is *still* intact, but the *libido* is already degraded to the nursing stage and sets up a relation with the thinking faculty as it exists. The consciousness of personality has been lost, and this loss is shown in the patient's inability to locate his intact psychic inventory. The patient who declares that his thoughts and feelings are in all people's minds merely declares, in words and concepts derived from the memory reserve of a later developmental stage, that his *libido* finds itself at the stage where it is still identical with the outer world, still has no ego boundaries set up against the outer world; and his libido is now compelled, therefore, to renounce the normal intellectual object relations insofar as these depend on the degraded libido position.

These feelings and this mode of expression depend on the intactness of the psyche's ability to operate with memory perceptions. This faculty, too, may undergo regression,[12] in which case the patient hallucinates. The libido has retreated behind the stage of identification, the intellect no longer knows how to establish a relation to the outer world, even by means of identification. The psyche is approaching closer and closer to the mother's womb.

Furthermore, may not perhaps "picture-seeing in planes" represent a stage of the development of the visual sense still earlier than the hallucinatory stage?

V

I have stated that narcissistic self-discovery and self-choice repeat themselves with every new acquisition of the ego, to the effect that, under the guidance of conscience and judgment, each new acquisition is either rejected or cathected with libido and attributed to the ego. I shall call this "narcissism," or "psychic narcissism," and contrast it with the organic narcissism that guarantees in the unconscious the unity and functioning of the organism. There is nothing new in calling attention to the great dependence of physical health, and even of life itself, on what is called "love of life," or in the reminder that one can actually die of a "broken heart," and that, as Wilhelm Ostwald mentions in his book on *Great Men*, university professors emeritus often die soon after they have been absolved of their duties, even when they have previously been in the best of health.[13]

They die not of old age but because they lose the love of life when they can no longer perform the duties they have loved. Freud tells of a famous musician who succumbed to his illness because of the discontinuation of his creative work.

The Distribution of Narcissistic Libido and Its Significance for Hypochondriasis, "Entfremdung" and Projection. We must assume that the libido flows through the entire body, perhaps like a substance (Freud's view), and that the integration of the organism is effected by a libido tonus, the oscillations of which correspond to the oscillations of psychic narcissism and object libido.[14] On this tonus depends the resistance to illness and death. Love of life has saved many a man whom physicians had given up as incurable.

Whenever there occurs an influx of organic narcissism to a given organ as a site of predilection,[15] there may also occur a consciousness of organ relations and organic functions that, in normal life, are relegated to an unconscious and vegetative role. Analogously, objects cathected by psychic narcissism and object love come to consciousness wherever the cathexis has reached a sufficient degree of strength. This influx of libido directs attention to the organ and provides the consciousness of a transformation of the organ or its functions, that is, the feeling of estrangement. This is the mechanism described by Freud as hypochondria. This influx of libido is followed by the turning away of the ego from the organ pathologically overcharged with libido, or from its functions — that is, by estrangement.[16] This is to be considered a defensive measure against the anxiety associated with hypochondria. The feeling of strangeness is a defense against libidinal cathexis, no matter whether it concerns objects of the outer world, one's own body or its parts. Of course, the estrangement does not cause the giving up of the unconscious libido position. The estrangement is not a destructive force but merely a denial of the pathological cathexis; it is an instance of the ostrich tactics of the ego, which may be very easily reduced ad absurdum, and which must ultimately be supplanted by other or more effective measures of defense.

When, in paranoia, the feeling of estrangement no longer affords protection, the libidinal drive toward the homosexual object is projected onto the latter and appears, by a reversal of direction, as aggression toward the loving one (the patient himself) in the form of a sense of persecution. Strangers become enemies. The enmity is a new and more energetic attempt at protection against the rejected unconscious libido.

The narcissistic organ libido in schizophrenia may undergo a similar transformation. The estranged organ — in our case, the entire body — appears as an outer enemy, as a machine used to afflict the patient.

Three Stages in the History of the Development of the Influencing Machine. Three principal stages in the history of the influencing machine should be distinguished, then:

First: The sense of internal alteration produced by the influx of libido into a given organ (hypochondria).

Second: The feeling of estrangement produced by rejection, whereby the pathologically altered organs or their functions are, so to speak, denied and eliminated as something alien to the wholly or partially sound organs and functions accepted by the ego.

Third: The sense of persecution (*paranoia somatica*) arising from projection of the pathological alteration onto the outer world, by attribution of the alteration to a foreign hostile power, and by the construction of the influencing machine as a summation of some or all of the pathologically altered organs (the whole body) projected outward. Note that among these organs the genitals take precedence in the projection.

The assumption of an influx of libido into specific organs, in the physiological sense of the word, should receive proper consideration. On the basis of this assumption, transient swellings of organs, often observed in schizophrenia without inflammation and without an actual edema, may be interpreted as equivalents of erection, produced like erections of the penis and clitoris by an overflow of secretion resulting from libidinal charging of organs.[17]

VI

Differentiation of Two Types of Projected Objects in Their Relation to the "Machine." It is not at all surprising that the hostile apparatus is handled by persons who, to an objective observer, cannot but appear as love-objects — suitors, lovers, physicians. All these persons are associated with sensuousness, deal with the body and demand a transfer of libido to themselves. This is what actually occurs in normal situations. But the narcissistic libido, whenever too strongly fixated, cannot but regard this demand made by love-objects as inimical and looks on the object as an enemy. It should be noted, however, that another group of love-objects — mother, the patient's present physician, close friends of the family — are counted not among the patient's persecutors but among the persecuted, compelled to share his fate in being subjected to the influencing machine. In contrast to paranoia, the persecuted and not the persecutors are organized into a passive conspiracy, and this conspiracy is of a passive nature. Of this phenomenon the following explanation may be offered:

It is noteworthy that the persecutors are all persons who live at some distance from the patient, whereas the persecuted belong to the closest circle of acquaintanceship and — including the physicians who are images of the father and hence also family members — represent a kind of constantly present family. Now, the family members are those love-objects who, because of their presence from the beginning of the patient's life, are subjected to the narcissistic object choice by identification. To these persons our patient still applies this form of object choice insofar as he subjects them to his own fate, identifying himself with them. Normally, the demand for transfer of libido with respect to members of the family is not felt as requiring either the overcoming of any great distance or any substantial sacrifice of narcissism. In establishing an identification with these persons, the patient follows a well-trodden path, which does not appear sufficiently inimical to the patient to force him to revolt against the cathexis of these objects and to regard them as hostile. It is different with lovers and suitors. These threaten a narcissistic position with their substantial demands for object libido and are, therefore, repulsed as enemies. The fact that these persons are spatially distant evokes a feeling of distance on the part of the libido. The transfer of libido *par distance* is felt as an extraordinarily strong demand for the acknowledgment of an object position, as a demand for self-denial. This also holds for normal conditions. Spatial distance separating the beloved threatens the object libido; it even leads people, ultimately, to withdraw themselves and give up the object. To have to love at a distance is a difficult task, only unwillingly performed. Our patient, however, cannot simply give up love-objects in a normal way, because he has not cathected them normally. To those demanding much from him, he can only react with the paranoid mechanism; to those demanding less, only with identification. I do not know why the persons who work the influencing machine are in my observation exclusively male. This may be due to faulty observation or to chance. Further investigations must clarify this point. However, that heterosexual objects can appear as persecutors, in contradiction to Freud's theory of the exclusively homosexual genesis of paranoia, may be explained by the fact that the influencing machine corresponds to a regressive psychic stage in which the important distinction is not between the sexes but between narcissistic and object libido, and every object demanding a transfer of libido is regarded as hostile, irrespective of its sex.

VIII

After this long digression — which, I hope, will not be regarded as superfluous — I shall return to the question of how even the ordinary, clinically familiar influencing machine in its typical form can be a projection of the patient's body, as was true in the case of Miss Natalija A. The answer should not be difficult to discover. If one does not want to assume that the machine has been established by successive substitutions of the parts of the patient's idea of his own body picture ("*wie Fuchs aus alopex*"),[18] and if one makes use, rather, of the genitality of the machine as previously established to explain the typical influencing machine, one should avail oneself of the following considerations:

The regression of libido to the early infantile stage determines the retransformation of the meanwhile genitally centralized libido into the pregenital stage, in which the entire body is a libidinal zone — in which the entire body is a genital. Such fantasies are also found in cases of narcissistically strongly cathected, sexually extremely infantile, neurosis. I have myself observed such cases. The fantasy originates in the intrauterine (mother's body) complex and usually has the content of the man's desire to creep completely into the genital from which he came, refusing to content himself with any lesser satisfaction. The entire individual is, in this case, a penis. Further, the road of identification with the father (the penis of the father) is overdetermined in the symptom formation of male patients. The symptom is also to be conceived as regression to a stage of diffuse, narcissistic organ libido and is, in most cases, associated with genital impotence. The genital, too, is renounced.[19] The same situation is revealed by the lack of genitalia in the influencing machine of Miss Natalija A. The intrauterine fantasy and the identification[20] with mother probably find expression in the domelike lid of the trunk, which perhaps represents the patient's mother during pregnancy. The enclosed batteries are perhaps the child, which is the patient herself. The fact that the child is equated with the batteries, that is, with a machine, lends further support to

Early television transmission, c. 1929.

the supposition that the person feels himself to be a genital — all the more so because the machine's lack of genitalia stands for the pregenital, in a certain sense, nongenital stage.

The construction of the influencing apparatus in the form of a machine, therefore, represents a projection of the entire body, now wholly a genital.

The fact that the machine in dreams is nothing but a representation of the genital raised to primacy in no way contradicts the possibility that it is, in schizophrenia, a symbol of the entire body conceived as a penis, and hence a representative of the pregenital epoch. The patient has indeed not lost the ideational content of his past life. The picture of the genital as a representation of sexuality has been retained in the psychic apparatus. It is, therefore, used as a means of representation, a mode of expression, a language in which phenomena existing prior to this means of expression are communicated. Here, the genital is merely a symbol of a sexuality older than the symbolism and than any means of social expression. The picture, then, is in the language of the later genital period nothing but: "I am sexuality." But the context is, "I am wholly a genital." This test has, of course, to be translated into the language suited to the actual libido conditions.

It is possible that the ordinary influencing apparatus, in the form of the machine, owes its existence simply to the fact that its early stages were not formed gradually, because the pathological process seized too precipitately on remote phases of existence. It is also possible that the early stages were not noticed by observers and not reported by the patient, or not recognized and evaluated as early stages. Thus, the connection between the influencing apparatus of Miss Natalija A. and the ordinary influencing machine has been lost to science.

But the contradiction between the two concepts — on the one hand, that the machine form of the influencing apparatus originated through successive distortions of the influencing apparatus that represents the projection of the body, and on the other, that the machine form of the influencing apparatus represents, like the machine in a dream, a projection of the genitalia — is now abolished. The evolution, by distortion of the human apparatus into a machine, is a projection that corresponds to the development of the pathological process that converts the ego into a diffuse sexual being — or, expressed in the language of the genital period, into a genital, a machine independent of the aims of the ego and subordinated to a foreign will.[21] It is no longer subordinated to the will of the ego, but dominates it. Here, too, one is reminded of the astonishment of boys when they become aware for the first time of erection. The fact, moreover, that the erection is shortly conceived as an exceptional and mysterious feat supports the assumption that erection is felt to be a thing independent of the ego, a part of the outer world not completely mastered.

NOTES

1. At the Belgrade Neuropsychiatric Division.

2. Taken literally, this patient's words, "*Sich verstellt*," mean "moves oneself from one place to another" — TRANS.

3. Victor Tausk, "Zur Psychologie des alkoholischen Beschäftigungsdelirs," *Internationale Zeitschrift für Psychoanalyse* 3 (1915) [trans. Eric Mosbacher and Marius Tausk, as "On the Psychology of the Alcoholic Occupation Delirium," *The Psychoanalytic Quarterly* 38.3 (July 1969), pp. 406–31].

4. Published in *Internationale Zeitschrift für Psychoanalyse* 2 (1914), p. 466. Miss N. dreams: "I am seated on an upper bench in the surgical amphitheater. Below, a woman is being operated on. She lies with her head toward me, but I cannot see the head, as it seems to be concealed by the lower benches. I see the woman only from her chest down. I see both thighs and a heap of white towels and linens. I see nothing else clearly."

Analysis of the dream reveals that the dreamer sees herself as the woman operated on. A few days before the night of the dream, the dreamer called on a young physician who made advances to her. On this occasion she was reclining on a couch. The physician raised her skirts and while he operated "below," she perceived the heap of white underclothes overhead. Just as she saw of herself in this situation, she sees of the woman in the dream, and the woman's head remains invisible to her just as she could not see her own head in the actual situation. According to Freud, the "woman without a head" in a dream represents the mother. The basic reason for this interpretation will not be discussed here, but will be treated in another section of this paper.

5. This would fall into the period before the first successful lie, which occurs very early in infancy. Lies fabricated in the first year of life are nothing unusual; they can be observed especially in children who resist the regular elimination of bodily wastes when, by means of grimaces, gestures and inarticulated words, they mislead the training person into believing that they have had a satisfactory evacuation. The educator who allows herself to be deceived by the child must ultimately look to divine guidance in order to keep the child within the truth, when the latter, to gain forbidden pleasure, begins to enjoy the practice of lying. Very soon, the time arrives when recourse to the highest authority of omniscience becomes necessary. The introduction of the omniscient God in the educational system becomes, indeed, a necessity because, de facto, children learn to lie from parents and upbringers, who by misrepresentations and unkept promises make the child obey and teach him to disguise his true purposes. In order to safeguard the success of education, teachers cannot but transfer the power of omniscience to God — an authority that they themselves have abandoned. The incomprehensible nature of this deity precludes the possibility of practicing deception on him. Nevertheless, many children do not submit even to this authority, continually test their God with regard to His omniscience and not infrequently actually succeed in unmasking Him as a phantom of the dethroned parental, specifically paternal, power.

6. In the discussion of this paper at the Vienna Psychoanalytic Society, Freud emphasized that the infant's conception that others know its thoughts has its source in the process of learning to speak. Having obtained its language from others, the infant has also received thoughts from them; and the child's feeling that others know his thoughts, as well as that others have "made" him the language and, along with it, his thoughts, has therefore some basis in reality.

7. The cases in which inhibition endangers the intellect primarily are to be attributed to dementia.

8. The projection of the libido position of the psychic ego produces the symptoms of simple paranoia, the mechanism of which was discovered by Freud. In what follows, I shall omit from consideration the fact that ego-libido is necessarily homosexual in its strivings, that is, attracted by the sex that the ego itself represents. I shall describe briefly only one mechanism, which appears to be out of harmony with object-libido and which is exemplified by the symptomatology of our patient, Miss Natalija A.

The patient reports: After she had rejected her suitor, she felt that he suggested that her mother and she strike up a friendship with his sister-in-law, so that the patient might be more amenable to a later proposal on his part. What appears here as suggestion on the suitor's part is nothing more than the projection of the patient's own unconscious inclination to accept the proposal of marriage. She had rejected the proposal not without inner conflict and had vacillated between accepting and rejecting her suitor. She gave realization in action to the rejection, while she projected her inclination to accept the proposal onto the object of her conflicting desires and made it appear as the sensory effect of an influence on the part of the object, or in other words as her symptom.

The patient was ambivalent toward her suitor, and projected one side of the conflict, the positive libidinal one, while manifesting in action the negative side, the rejection, because this procedure was in conformity with her ego. The choice, which in this instance has projection as its outcome, may in other cases be the reverse one. Here, I am merely calling attention to the mechanism of partial projection of ambivalent tendencies.

A special contribution to the subject of the projection mechanism, which also made me aware of this principle, was made by Dr. Helene Deutsch in her discussion of this paper at the Vienna Psychoanalytic Society. A schizophrenic patient had the feeling that her friends always laid down their work when she herself began to work, and that they sat down whenever she stood up — in brief, that others were always performing the opposite of what she herself was doing. The patient merely felt this; she could not possibly see it, since she was blind. Dr. Deutsch regarded the symptom as a projection of one of two tendencies present in every one of her patient's actions — namely, the tendency to do and the tendency not to do. This interpretation was confirmed by cases presented by other commentators. On this occasion, Freud proposed the formulation that ambivalence makes the projection mechanism possible. Once expressed, this thesis appears self-evident. It has its corollary in another of Freud's contentions, to the effect that ambivalence produces repression. This has as its natural consequence the formulation mentioned above, since only what is repressed is projected, insofar as boundaries between the unconscious and the conscious still obtain. The entire problem furnishes special justification for Bleuler's term "schizophrenia," and at the same time corroborates Pötzl's views discussed in note 16, below.

The present paper shows how, albeit unconsciously, I had been demonstrating Freud's formulation.

9. Freud has already indicated in his paper on the Schreber biography ["The Psychotic Doctor Schreber," in *Three Case Histories* (New York: Collier, 1963), p. 163 — TRANS] that the libido in schizophrenia is located at a stage even earlier than autoeroticism. I arrive at the same conclusion by a different route, and I take the liberty of presenting this fact as proof of the correctness of Freud's contentions.

10. Sigmund Freud, *Introductory Lectures on Psychoanalysis*, ed. James Strachey (New York: W. W. Norton, 1966), "Some Thoughts on Development and Regression — Aetiology," pp. 339–57.

11. Many patients are actually aware of this regression to infancy and to the embryonic stage — the latter, though, only as a threat of further illness. A patient said to me: "I feel that I am constantly becoming younger and smaller. Now I am four years old. Shortly I shall get into diapers and then back into mother."

Dr. Helene Deutsch, during the discussion of this paper, reported the case of a thirty-one-year-old female schizophrenic who wet and soiled her bed and stated as her justification that "they were making a baby of her."

On the same occasion, Freud, referring especially to the influencing machine of Miss Natalija A., and to the interchangeability of sexuality and death, called attention to the significance of the mode of burial of the Egyptian mummies. To place the mummies in a case resembling the human body suggests the idea of the return to "mother earth," the return to the mother's body in death. Freud's reference shows how, as a compensation for the bitterness of death, men take for granted the bliss of existence in the uterus. The fantasy of return to the uterus is, then, an atavistic one, a preformed fantasy; and as such it may be added to the "primal fantasies" postulated by Freud. This fantasy appears symptomatically in schizophrenia as the pathological reality of the regressing, disintegrating psyche. The mummy returns to the mother's body by physical death, and the schizophrenic by psychic death. ("*Mutterleibsphantasie*" — an expression, as far as I know, first used by Gustav Grüner.)

12. For further discussion of this subject, see Sigmund Freud, "Metapsychological Supplement to the Theory of Dreams" [1916–17], in *Collected Papers*, ed. Joan Riviere (New York: Basic Books, 1959), vol. 4, pp. 137–52. This work appeared while the present paper was in proofs. I am pleased to be able to refer to the many points of agreement between my own contentions and those of Freud in his paper, of which I had no knowledge at the time.

13. Wilhelm Ostwald, *Grosse Männer* (Leipzig: Akademische Verlagsgesellschaft, 1909).

14. Melancholia is the illness the mechanism of which consists in the disintegration of psychic narcissism, in the renunciation of love for the psychic ego. Melancholia, in pure culture, is the paradigm of the dependence of the organic on the psychic narcissism. The separation of libido from the psychic ego, that is, the rejection and condemnation of the raison d'être of the psychic person, brings with it the rejection of the physical person, the tendency toward physical self-destruction. There occurs a consecutive separation of the libido from those organs that guarantee the functioning and the value of the physical individuality, a separation by means of which the organs' function is impaired or given up. Hence appetite is lost, constipation occurs, menstruation ceases and potency is lost — all as a result of unconscious mechanisms. This failure of function is to be traced to the destruction of the respective organic libido positions that are essentially vegetative, that is, unconscious; it is thus to be strictly differentiated from the conscious, deliberate suicidal tendency expressed in refusal of nourishment or in activities inimical to life.

Melancholia is the persecution psychosis without projection; its structure is due to a specific mechanism of identification. (Further discussion on this point can be found in my paper, "Diagnostische Erörterungen auf Grund der Zustandsbilder der sogen. Kriegspsychosen," *Wiener medizinische Wochenschrift* 37–38 [1916]. While this paper was in proof, Freud's article "Mourning and Melancholia" [1917], in *Collected Papers*, vol. 4, pp. 152–70, appeared, to which I refer in this connection.)

15. This involves the Freudian principle of the erotogenicity of organs, that is, of the erotogenic zones.

16. Dr. Otto Pötzl suggested on a certain occasion (I do not remember whether it was in connection with a thesis of his own or as an addendum to theories of others) that the catatonic stare is an expression of the patient's inability to apportion his motor impulses, disintegrated by the split of his volition into agonistic and antagonistic elements, so that a purposeful action may again be performed. (In Meyrinck's story, *Der Fluch der Kröte* ["The Curse of the Toad"], the millipede is unable to move a limb the moment he focuses his attention on the activity of any one of his thousand legs.)

Theory of catatonia: Pötzl's conception is in harmony with the psychoanalytic theory that the regressive narcissistic libido undergoes a pathological division with the cathexis of the individual functions of the psyche and the organs, such that agonistic and antagonistic portions of the purposefully directed antithetical pair of forces are brought into the reach of awareness by the disturbance of the equilibrium between their respective libido quantities and are deprived of automatic functioning. This would be a special case of hypochondria and estrangement related to the antithetical pairs of forces with their respective specific consequences.

Pötzl's view does not contradict the assumption that the outer world may be eliminated as a result of regressive narcissistic libido, and it actually allows the application of the theory of hypochondria to further special points in the psychophysical makeup of men. Pötzl's concept even suggests the hypothesis that there was, in the life of man, a period — not a definitely determinable period, it is true, and perhaps only potential — in which the activity of the antagonistic pair of forces was still automatic and had to be discovered and learned by the person himself as if from an alien outer world. This period may well be present in ontogenesis only as an "engram" of phylogenetic stages that comprised the origin of the now-complex motor organs from the simplest single-tracked active formations. Regression in schizophrenia would then be traceable to those "engrams" of the oldest era of the race, and the theory would demand that these phylogenetic traces of function retain their capacity for being reactivated. We must not shrink from this hypothesis. It provides us with another idea to use in investigating problems in schizophrenia: perhaps this remarkable disease consists in just this — that the phylogenetic vestiges of function retain in many individuals an extraordinary capacity for being reactivated. Psychoanalysis would have to make room for this conception, since psychoanalysis has already in many instances uncovered the roots of symptoms in the history of the species. From this it may perhaps be possible, via ontogenesis, to proceed to an explanation of the mysterious "electrical currents" complained of by patients. This paresthesia may once have been a sensation that accompanied the first nerve and muscle functions. It is perhaps a reminiscence of the sensation of the newly born being who enters the strange air of the external world out of the comfortable covering of the mother's womb, or for whom the latter is replaced by its first garments. The bed he first lays in is perhaps the one that comes in the patient's consciousness when he feels himself, while lying in bed, electrified by invisible wires.

17. These psychological assumptions are strongly supported from the organological standpoint by a report made some years ago by Fauser at Stuttgart on the presence of sexual secretion in the blood of dementia praecox patients, as demonstrated by Abderhalden's dialytic method. New and important findings in this connection are to be expected from Stemach's experiments. When the present paper was completed, there appeared in the *Müenchener medizinische Wochenschrift* 6 (1918), under the title, "Umstimmungen der Homosexualität durch Austausch der Pubertätsdrusen" ["Transformation of Homosexuality by Exchange of Puberty Glands"], a very interesting and significant article by Steinach and Lichtenstern, which realized these expectations. After the completion of this paper there also appeared in the *Internationale Zeitschrift für ärztl. Psa* 4 (1917), an article by Sandor Ferenczi, "Von Krankheits und Pathoneurosen" ["Disease or Patho-Neuroses," in *Further Contributions to the Theory and Technique of Psychoanalysis* (London: Hogarth Press and the Institute of Psychoanalysis, 1926), pp. 78–79], in which the assumption of the libidinal cathexis of individual organs in the sense above described appears to be applied with notable success.

18. "Like fox from alopex" — a student parody on etymological derivations consisting of the stringing together of rhyming and nearly rhyming words — TRANS.

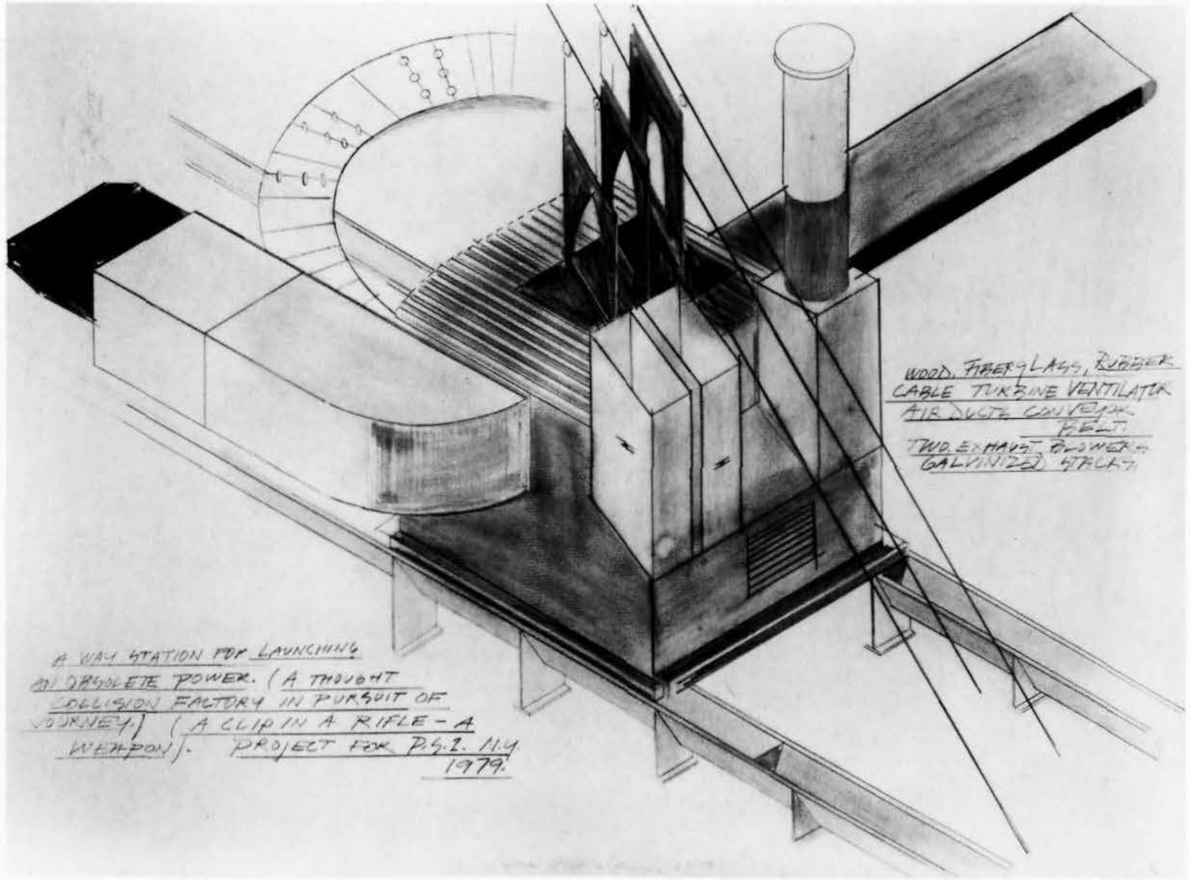
19. This renunciation of the genitalia is felt by the male schizophrenic as a loss of virility, which is "drained off" from him, or else as a direct transformation into a woman, corresponding to the infantile notion of boys that there is only one kind of genital, namely their own, and that those of women are the result of castration and really represent a loss of the genital. The castration complex is often combined with the infantile identification of semen with urine, resulting from urethral eroticism. I have observed an attack of castration anxiety while catheterizing a schizophrenic who refused to empty his bladder. He maintained that I was practicing coitus with him by means of the catheter and that I had emptied him of all his semen. Thus, his retention of urine appears as a refusal to yield semen, representing his virility. The patient's playing with excrement is explicable by the narcissistically rooted conception that feces and urine are parts of the body. Coprophagia is not inhibited by the thought that the excreta are nothing else than the body from which they come.

20. The proof of this identification derived from symbolic language has already been given in the dream of "the woman without a head," note 4, above.

21. Indeed, the machines produced by man's ingenuity and created in the image of man are unconscious projections of man's bodily structure. Man's ingenuity seems to be unable to free itself from its relation to the unconscious. See Hanns Sachs, "The Delay of the Machine Age," *The Psychoanalytic Quarterly* 2 (1933).

Translated from the German by Dorian Feigenbaum

A way station for launching an obsolete power. (A thought collision factory in pursuit of journey.) (*A clip in a rifle — a weapon.*)
Project for P.S.1, N.Y., 1979.
Dennis Oppenheim


WOOD, FIBERGLASS, RUBBER
CABLE TURBINE VENTILATOR
AIR DUCTS CONVEYOR BELT.
TWO EXHAUST BLOWERS
GALVINIZED STACKS.
A WAY STATION FOR LAUNCHING
AN OBSOLETE POWER. (A THOUGHT
COLLISION FACTORY IN PURSUIT OF
JOURNEY.) (A CLIP IN A RIFLE – A
WEAPON). PROJECT FOR P.S.1. N.Y
1979.